CRESTRON

DigitalMedia™

Design Guide

CRESTRON

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What is Crestron DigitalMedia™?

There's no question that the digital age is here today. Analog television is off the air; practically every device that plugs into a display has an HDMI port; the latest MacBooks® only provide DisplayPort outputs; laptops now include built-in Blu-ray players, and the latest video conferencing systems feature HDMI/DVI outputs exclusively. The products you›re using now won›t work for much longer. Crestron DigitalMedia (DM) is the only solution that answers the challenges of tomorrow – today.

Crestron began designing products with HDMI technology more than five years ago, and has shipped thousands of HDMI products over the last three years. But DM is more than just another HDMI switcher or extender; it's a complete, integrated solution that manages, controls, and distributes all analog and uncompressed HD digital content over twisted pair or fiber.

DM matrix switchers are flexible, modular systems that can accept virtually every signal type and transmit them long distance as digital DM signals. Built-in exclusive QuickSwitch HD™ technology, pre-authorized HDCP keys, maintains a constant handshake for continuous, glitch-free HD switching. At the end points, DM receivers output HDMI and control to the display.

Crestron DigitalMedia is the only solution for the digital age, distributing all analog and uncompressed HD digital signals, and managing embedded data such as HDCP, EDID and CEC.

Purpose of this guide

The purpose of the Crestron DigitalMedia™ Design Guide is to provide the following:

- Functional background on how High Definition, specifically HDMI, is constructed and transmitted
- How DM can solve HD distribution issues
- Provide detailed information to assist in the design of your HD media distribution system

For more detailed examples and additional installation details, please refer to the latest version of "All Rooms Digitally Connected" Doc 6251-(future)

What is HDMI?

High Definition Multimedia Interface (HDMI) is the first and only consumer electronics industry-supported, uncompressed, all digital audio/video interface. By delivering crystal clear, all digital audio and video via a single cable, HDMI dramatically simplifies cabling and provides consumers with the highest quality AV experience.

Advantages of HDMI versus Analog Interfaces

HD content ready: Consumers using HDMI devices supporting HDCP have the comfort of knowing that they will have access to premium HD content now and in the future. Content providers (a.k.a. movie studios and television networks) are requiring that devices transmit HD video to only "protected outputs" that use HDCP. With today's HD movies, content can be sent over unprotected interfaces—such as analog component—because Blu-ray has delayed the activation of the image constraint token (a.k.a. content protection flag) to help minimize potential transition issues. After December 31, 2010 new players must limit analog video output of Blu-ray disc content to interlaced standard definition (480i/576i). 2013 is the expiration date for analog video: no player that passes "Decrypted AACS Content" to analog video outputs may be manufactured or sold after December 31st, 2013. This means future HD movies will stop being viewable at HD resolutions over analog component and other unprotected interfaces. A similar situation exists with cable and satellite TV, in which the Motion Picture Association of America (MPAA) is petitioning the FCC to restrict HD transmission to protected outputs.

Quality: Because HDMI is a digital interface, it has lossless transmission and provides the best video quality, unlike analog video. The difference is especially noticeable in low brightness scenes and at higher resolutions, such as 1080p. Digital video is sharper than component, and eliminates the softness and ghosting found with component. Small high contrast details, such as text, especially bring out this difference.

Ease of use: HDMI combines video and multi-channel audio in a single cable, eliminating the cost, complexity, and confusion of multiple cables currently used in AV systems. This is particularly beneficial when equipment is upgraded or added.

Intelligence: HDMI supports two-way communication between the video source (such as a DVD player) and the DTV, enabling new functionality such as automatic configuration. By using HDMI, devices automatically deliver the most effective formats (e.g., 480p vs. 720p, 16:9 vs. 4:3) for the displays to which it is connected, eliminating the need for external intervention to identify the best resolutions and audio formats.

It's Not Just Cable Length

The promise of HDMI is great. One cable carrying uncompressed digital HD video and audio; what's not to like? But mention HDMI to an AV integrator and you're likely to get an expletive in response. A quick search of online forums and industry trade publications uncovers a slew of HDMI related complaints, ranging from annoying switching delays and screen flashing to complete audio and video failure.

There are two primary reasons for HDMI problems: bandwidth and complexity. Uncompressed HD video requires enormous digital bandwidth, which is notoriously difficult to push through copper wire. Add popular features such as 1080p resolution and the potential offered by Deep Color, and the problem worsens.

There are a number of products appearing on the market that attempt to address this issue, some of which actually work quite well. But the under-discussed issue is the sheer complexity of HDMI.

HDMI is a full-duplex digital communications interface. The creators of HDMI took advantage of its digital nature, and added several communications mechanisms to automatically control and encrypt content. Unfortunately, the custom installation industry wasn't considered in the design process, and HDMI doesn't scale well. Compounding the problem is the fact that digital control is relatively new to most of the major AV distribution players, so the learning curve has been very steep.

Though much more complex than analog, HDMI isn't nearly as complicated as home automation, Ethernet, or any of the myriad wireless protocols. Companies with experience in these fields are in a position to implement HDMI in environments that the designers hadn't anticipated.

This portion of the guide addresses the need for the move to HDMI and explains the new features that HDMI supports. We'll demystify the "handshaking" that occurs between HDMI sources, repeaters, and displays, and explore the cause of some common problems experienced in the field.

Say Goodbye to Analog

Before we get too involved in the technical details, there's an important question to address: why do we need HDMI? Although analog video distribution works very well for much of the market, analog is on its way out. Content providers such as television and movie studios love the fact that HDMI supports the High-bandwidth Digital Content Protection (HDCP) protocol. HDCP allows them to encrypt content while it's on the wire, so it can't be copied and pirated easily. They're pushing hard on the consumer electronics industry to move from analog to HDMI, and they're making progress. For the unconvinced, here are a few harbingers of analog's demise:

Image Constraint Token: The Blu-ray specification has a built-in time bomb: the Image Constraint Token (ICT). This embedded flag forces players to downgrade video on analog outputs to standard definition, which is one quarter the resolution of the current analog maximum, 1080i.

Content provider support: SkyHD, a popular European satellite service, is already shipping HDMI-only set top boxes. In the United States, the Motion Picture Association of America (MPAA) is petitioning the FCC for permission to block movies from being transmitted on set top box analog outputs.

Feature support: The latest and greatest features are only supported by HDMI. The aforementioned formats aren't, and will never be, available over analog. The more discerning consumers, who are the bread and butter for much of the custom installation industry, expect these sophisticated features.

Any analog distribution system that carries commercially created content runs the risk of becoming obsolete over the next several years. Now is the time for the consumer electronics and custom installation industries to embrace the transition.

Comparing the Cables

Analog Cables

- Separate audio and video cables
- Robust signals
- Field termination
- Inexpensive
- Installer friendly
- Reliable multi-room distribution
- Distance is rarely an issue
- Secure cables
- No copy protection (DRM) support

HDMI Cable

- Single AV cable
- Delicate signals
- Cannot be field-terminated
- Very expensive
- Difficult to run
- No reliable multi-room solution
- Limited distance
- Non-locking cable
- Supports copy protection

The complexity of HDMI becomes obvious when you compare HDMI cable to analog audio and video cables. Analog cables typically consist of one to three wire pairs, depending on the format, and they simply carry an audio or video signal (not both). In contrast, the HDMI cable consists of 19 wires, which carry high speed video, audio and other digital information. The digital audio and video data is encoded into three color channels and a clock channel. Audio is embedded inside the video data and is inserted and extracted at each end. Additional information carried by HDMI includes:

DDC: The Data Display Channel (DDC) is a two-way communications interface between the source and the downstream repeater or display device. This channel was originally provided to communicate device capability information, which is encoded in a structure known as Extended Display Identification Data (EDID). HDMI devices use EDID to indicate what audio and video formats they support, discussed in more detail in a later section. The DDC interface is also used to set up and maintain HDCP encryption.

Hot Plug Detect: The downstream device, or sink, indicates its presence to the source with the Hot Plug Detect (HPD) signal. This allows each device to know when a cable has been connected and to start authentication.

CEC: Consumer Electronics Control (CEC) channel wiring is mandatory, although implementation of CEC in a product is optional. The CEC channel uses the industry standard AV Link protocol for remote control functions, and is a one wire bidirectional serial bus. The CEC feature allows the user to command and control multiple CEC-enabled boxes with one remote control, and individual CEC-enabled boxes to command and control each other without user intervention.

Depending on the device and manufacturer, DDC, HPD, and CEC signals interact differently. This inconsistency can negatively affect device performance.

Additional control signals are associated with HDMI, but they are beyond the scope of this guide.

Topology

Every HDMI installation consists of at least one content source, like a cable box or Blu-ray player, and a sink, like a TV or a projector. Most custom installations also involve at least one repeater, which is a device that accepts and re-transmits HDMI content. Repeaters include simple devices such as switches and distribution amplifiers as well as more feature-rich devices like audio and video processors.

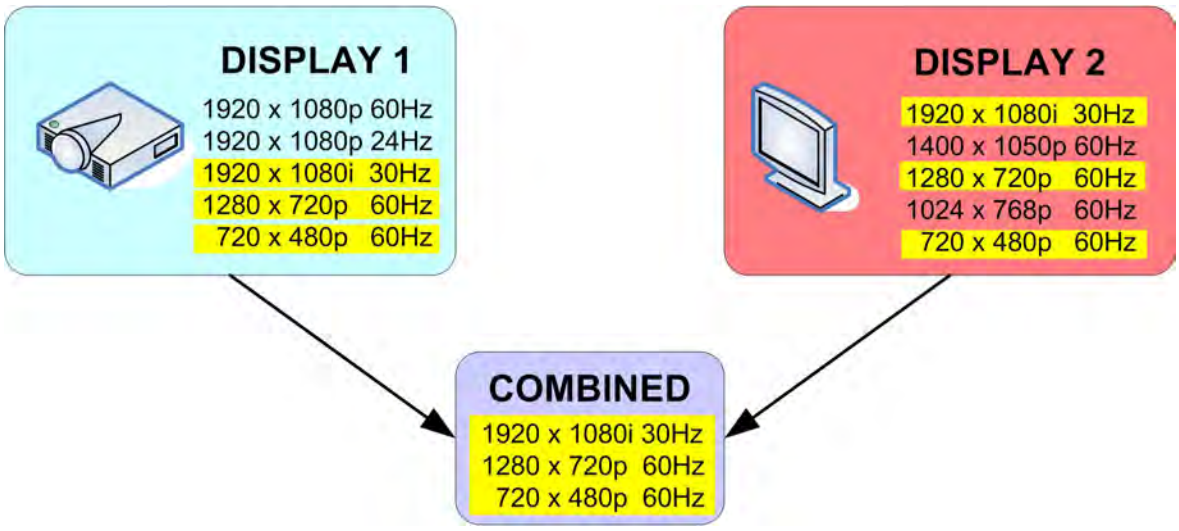
EDID

EDID is the information transmitted from a display to a source conveying its resolution capabilities. Initially developed for computers and monitors, EDID has made its way into consumer electronic devices via HDMI. HDMI display devices and surround sound receivers use EDID to communicate their audio and video capabilities. For instance, a television may use EDID to indicate support for the standard HD resolutions plus 1080p and Deep Color. Another TV may not accept higher than 720p/1080i resolution. One audio processor may support Dolby TrueHD while another only supports standard Dolby; most TVs only support basic stereo audio. All of this information is stored in EDID.

The content source reads and analyzes EDID to determine what formats to send. It is the responsibility of the source, if equipped, to only send formats that the downstream devices support. For example, Blu-ray players include video scalers to best match the disc's native format to the capabilities of the television or projector.

In the simplest installations, with one television and an audio processor, the EDID protocol works reasonably well. Multi-room installations, on the other hand, can quickly become problematic, with several televisions connected to several sources through one or more HDMI switches. The switches are responsible for collecting all of the televisions' EDID and providing one unified version to the source. Neither the HDMI nor the EDID specifications offer guidance in this scenario. As a consequence, different switches behave in different ways. Combining multiple EDID can be a complicated issue, so it's worth researching how a given switch handles it prior to installation.

Consider a simple system. The client has a 1080p projector with a surround sound processor in the home theater, and a 720p LCD with integrated speakers in the family room. The 1080p projector also supports 720p, but obviously the customer would prefer 1080p where possible. How should the switch combine the EDID? Some devices on the market simply copy the EDID from the first output. In our scenario, 1080p video and surround sound audio is sent to the family room, which supports neither. At best, this results in no audio and no video and at worst, damage to the LCD display or speakers. A slightly smarter switch may take a "best common" approach, generating merged EDID that limits the content to only what both rooms can support; 720p video and stereo audio. Now, the client's sophisticated home theater can no longer achieve exceptional content quality. Expand this scenario to the installation with five or ten rooms and this simple solution becomes inadequate.



Crestron DigitalMedia is an intelligent system that allows installers to make design decisions that set the fewest limits (if any) on content quality across multiple displays. For example, let's say the client only watches Blu-ray content in the home theater, but watches cable TV in both the home theater and the family room. With the proper switch, the installer can configure input EDID independently, so that the Blu-ray player can send the full 1080p and surround sound signal to the home theater, while the cable box, which must support both rooms, is limited to 720p or 1080i. This isn't much of a sacrifice, since cable companies don't actually transmit 1080p content anyway (though some cable boxes will up-convert to 1080p). A really nice switch accepts surround sound for the home theater, and down-mixes it to basic stereo for the family room.

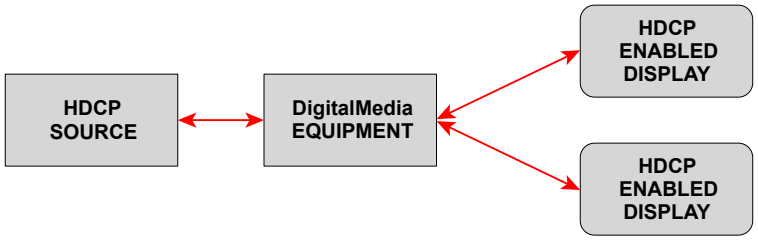
HDCP

HDCP encryption is another complicating factor in HDMI installations. The HDCP system has two parts:

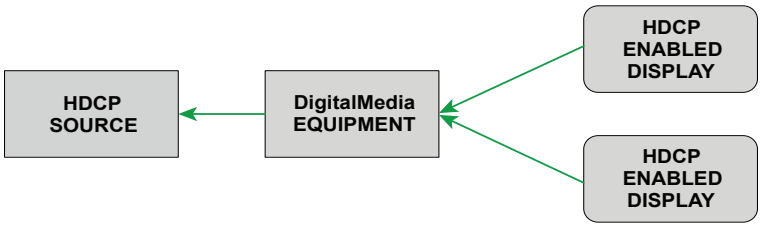
1. Authenticates HDCP devices to make sure they are authorized to receive the content
2. Encrypts the content to prevent interception during transmission

Authentication ensures that all devices receiving the content are licensed and authorized. Only after successful authentication can the display output the audio and video streams.

HDCP Encrypts Each Individual Segment of an AV Transmission



HDCP Authenticates Each Device via the Source



Devices that re-transmit HDCP content must inform the source of all the downstream connections in the system. Every HDCP device has a unique ID, known as a KSV (Key Selection Vector), which must be passed to the source. The source must then verify each device before it transmits content. It is this authentication process that causes the 5-10 second switch times in HDMI devices.

DigitalMedia solves this “blank screen” issue by using a technology called QuickSwitch HD™. In a standard HDMI switcher, each display is authenticated dynamically when video is routed to it. With DigitalMedia, the authentication process takes place as displays are added. During initialization, sources are authenticated with each display through the DigitalMedia system before any audio or video is routed. By doing this, each switch can occur quickly.

Unfortunately, all sources have a hard limit on the number of displays that can be connected, due to a limit in the number of KSVs they will accept. The HDCP specification allows for up to 127 devices, but sources usually support far fewer. Many support fewer than ten devices, and for at least one popular cable box in the field, it’s only one. If a repeater presents a source with too many KSVs, the source stops transmitting content. Unfortunately, KSV limits are not an advertised feature. Clients won’t even realize they have a problem until they try to route a given source an extra repeater or display. Audio and video drops out inexplicably in all connected rooms, typically without so much as an error message.

Again, a solution is needed that allows installers to make intelligent design decisions. During commissioning, the DigitalMedia system tests the KSV limits of each source, and sets appropriate limits on the switch. It will bring any problem areas to the attention of the installer, to be solved before becoming end user issues.

Installers must be aware of KSV limit issues in any HDMI installation that involves more than one display. Be sure to research how your equipment handles scenarios that violate source KSV limits using the device list (page 52) and by testing devices in the field.

Consumer Electronics Control (CEC)

Each HDMI cable contains a communication link that enables devices connected via HDMI to talk to each other. This protocol is called Consumer Electronics Control (CEC). When a control system is in place, however, you don't want other devices issuing commands. CEC is supposed to contain industry standard commands for interoperability, but inconsistent support from CE manufacturers has caused a wide variation in the functions that can actually be triggered from each device. Some examples of this functionality that Crestron has discovered are:

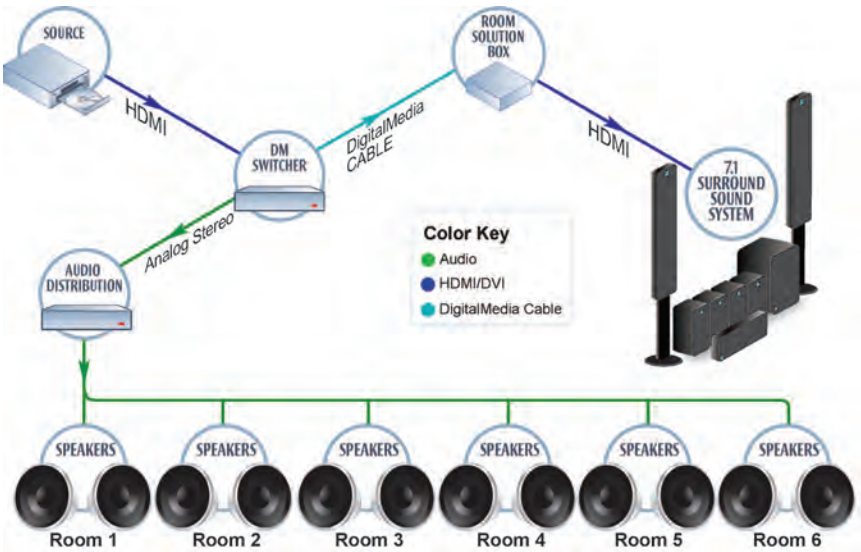
- Multiple DVD players from the same manufacturer, in the same system, communicate with each other so that only one can play at a time. Every time one player is issued the play command, the player sends a pause command to the other players over CEC
- When a Blu-ray player is turned off, it sends a power off command, turning off all the displays connected to the system.

These functional commands are a major issue, because they are sent behind the scenes and without your knowledge. DigitalMedia breaks the communication path between the HDMI devices that are connected to the switch, so these commands cannot be sent without your approval. In addition, DigitalMedia provides a method to issue CEC commands from a control system, so the communication link can be used for your benefit, as an alternative to IR and RS-232 control.

Audio

HDMI provides the only transmission link for 7.1 channel HD audio. However, unlike traditional analog video sources, HDMI sources usually do not transmit multi-channel and 2-channel audio at the same time. This becomes a problem for multi-room distribution, in which a mixture of surround sound and stereo audio rooms are present. HDMI sources will often shut off analog outputs when sending audio over HDMI.

Audio Distribution



Crestron DigitalMedia solves this problem by offering special HDMI cards that will take in a multi-channel audio stream and output both types of audio for distribution. These special cards are noted by a –DSP suffix.

Convergence

HDMI enables computers to deliver premium media content, including high-definition movies and multi-channel audio formats. It is the only interface enabling direct connections to both HDTVs and digital computer monitors implementing the DVI and HDMI standards, which amounts to hundreds of millions of existing DVI displays.

HDMI is fully compatible with all DVI-enabled computers, because HDMI was developed using the same technology as DVI

(Digital Visual Interface), which has been the most common digital connection for computers. Because HDMI offers both audio and video over one cable and DVI only carries video, DVI/HDMI connectivity requires a separate audio cable.

DisplayPort

DisplayPort is a newer VESA standard for digital video connection, similar to HDMI in functionality. While HDMI was introduced in 2001, the latest DisplayPort specification (1.1a) was released in 2008, which has given HDMI devices a huge head start in device adoption. The DisplayPort standard was driven by the PC industry, to achieve a low cost process for transferring video from a computer to a laptop screen and external digital video output. Both protocols support 1080p and higher resolutions, HDCP content protection, multi-channel audio and Deep Color. HDMI additionally supports some items that DisplayPort does not, such as CEC control and Dolby/DTS 8-channel audio streams.

VESA realized that they were late to the digital video game with DisplayPort, and it didn't make sense to have a video output that could not plug into 95% of the displays in the world today. They created DisplayPort Multimode to enable compatibility with HDMI and DVI (and sometimes RGBHV – but that doesn't include content protection). This means that an HDMI input can accept video from DVI, HDMI and DisplayPort devices – making it the most universal connector going forward.

Summary

Wide support from content providers and the consumer electronics marketplace makes HDMI the future of HD video transmission. This brings many pitfalls to the uninformed installer (especially in larger installations) and the problems are not limited to cable length issues. Processing EDID and managing HDCP requires complex microcontrollers, especially when several rooms are involved. Switching systems must be easily customizable to intelligently handle HDCP and EDID. DigitalMedia manages these various communication mechanisms and provides extensive troubleshooting information, so the installer can solve issues like cable failure, device incompatibilities and content protection complications.

Crestron DigitalMedia

Crestron DigitalMedia distributes uncompressed digital audio and video signals over a choice of shielded twisted pair copper wire or fiber optic cable. A full selection of switcher input cards, transmitters, and room controllers (receivers), provides extensive connectivity throughout the installation, supporting a complete range of analog and digital signal types. DigitalMedia intelligently manages all the different signals and devices, matching each source's output to the capabilities of the selected display(s) without scaling or compression. Every signal is preserved in its native video resolution and audio format, ensuring a pure, lossless signal path.

DigitalMedia handles more than just audio and video. Integrated Gigabit Ethernet, device control (IR, RS-232, CEC) and USB HID mouse and keyboard distribution allows computers, media servers, and video game consoles to be installed out of sight and accessed from anywhere in the installation. With no additional wiring, built-in Crestron control is also available for controlling displays and other room devices.

DigitalMedia:

- Distributes uncompressed digital audio and video over shielded twisted-pair wire (DM CAT or DM 8G STP) or fiber
- Supports HDMI with Deep Color and 7.1 channel HD lossless audio
- Supports video resolutions up to 1920x1200 or 1080p/60
- Allows full 1080p/60 up to 450 feet using DigitalMedia cable
- Supports 50/125 and 62.5/125 multimode fiber for distances up to 1,000 feet (300 meters)

Features of DigitalMedia

DigitalMedia transmits a wide variety of signals:

Audio	Video	Data
HDMI 7.1 Channel	HDMI	Ethernet
2, 6, or 8 channel PCM	Component (Y/Pb/Pr)	IR
DTS-HD Master Audio™	S-Video	RS-232
Dolby® TrueHD	Composite	USB HID
SPDIF	RGBHV	Crestron Control
2-Channel Analog	DisplayPort Multimode	
DisplayPort Multimode	HD-SDI	
	DVI	

DigitalMedia is installer-friendly, with a flexible choice of input and output cards. It expands easily to serve the most demanding multi-room solution. Advanced troubleshooting tools can be accessed via the front panel, Crestron Toolbox software, and control system to identify potential problems with HDCP keys and handshaking, CEC control, video resolutions, USB, wiring and audio format issues. DigitalMedia accommodates legacy AV systems, provides a zero-latency solution, and drives full HD content without compression or resolution loss.

Computer Compatibility

Besides handling every available HDTV format supported by HDMI, DigitalMedia also supports the distribution of DVI and RGB computer signals, and is fully compatible with DVI computer monitors up to 1920 x 1200 WUXGA.

USB HID Switch

DigitalMedia lets you centralize all HD sources – not just television receivers and DVD changers, but also media servers, computers, and even video game consoles. Built-in USB HID (Human Interface Device) signal routing allows USB HID compatible keyboards, mice, and game controllers to be connected at each display location, extending their signals through to the centralized equipment via USB HID ports provided on select switcher input cards.

EDID Format Management

Using HDMI provides a variety of video and audio formats to keep track of, and chances are not every device in a system supports all of the same formats. In a typical one-room system, HDMI attempts to resolve this confusion using EDID. When two HDMI devices are connected together, the receiving device (a display or surround sound processor) uses EDID to announce its format capabilities to the source device (a TV tuner or video player), which in turn configures itself to output the most effective format that both devices can support.

However, serious conflicts can arise in a facility filled with different displays and audio systems. For instance, a Blu-ray player feeding a 1080p projector in the home theater may restrict itself to a lower resolution, or even shut off completely, if someone decides to view the same signal on the 32" TV in the bedroom. And, instead of listening to a 7.1 Dolby TrueHD format supported by a high-end theater sound system, the listening experience may be limited to Dolby 5.1, or even stereo sound.

DigitalMedia uses EDID to prevent such conflicts, assessing the formats supported by each system device, and then allowing the installer to assign compatible devices in logical arrangements. Conflicting combinations can be prohibited so only the optimum signal formats get delivered to each display and audio system in the house. Refer to the EDID section on page 4.

QuickSwitch HD™ Technology

Many content providers are using the copy-protection scheme called HDCP to protect products against unauthorized copying. To view HDCP encrypted content in full high-definition requires the source device to "authenticate" every display and signal processor through an HDMI connection before delivering an output signal. This process occurs every time any HDMI signal is switched, causing a complete loss of signal for up to 15 seconds whenever a new source or display is selected anywhere in the house. Crestron QuickSwitch HD technology eliminates this issue by maintaining a constant HDCP connection with each HDMI device in the system. By eliminating the need to re-authenticate each time a different source or display is selected, QuickSwitch HD achieves very fast switching of HDMI signals.

HDCP Key Management

Another aspect to HDCP is its use of "keys" to manage the handshaking that occurs between any two devices. Every HDMI source device supports a limited number of downstream devices, as determined by the number of HDCP keys available. The number of HDCP keys is rarely advertised or specified by the manufacturer or service provider, so without warning, the source simply stops outputting a signal when connected to too many displays or processors. To prevent such surprises, DigitalMedia switchers test the HDCP limits of each HDMI source, allowing the installer to configure the system around any limitations, or substitute a different component.

CEC Signal Management

The primary objective of every Crestron system is to enable precisely the control desired for a seamless user experience. To ensure this outcome, DM switchers intercept the CEC signals that many HDMI devices automatically generate, preventing any unwanted commands from being executed – like a Blu-ray player attempting to turn off the video display when it gets turned off, or a DVD player trying to pause the other players in the system when it is playing. Through proper CEC management, DigitalMedia allows you to take control of each device as you like.

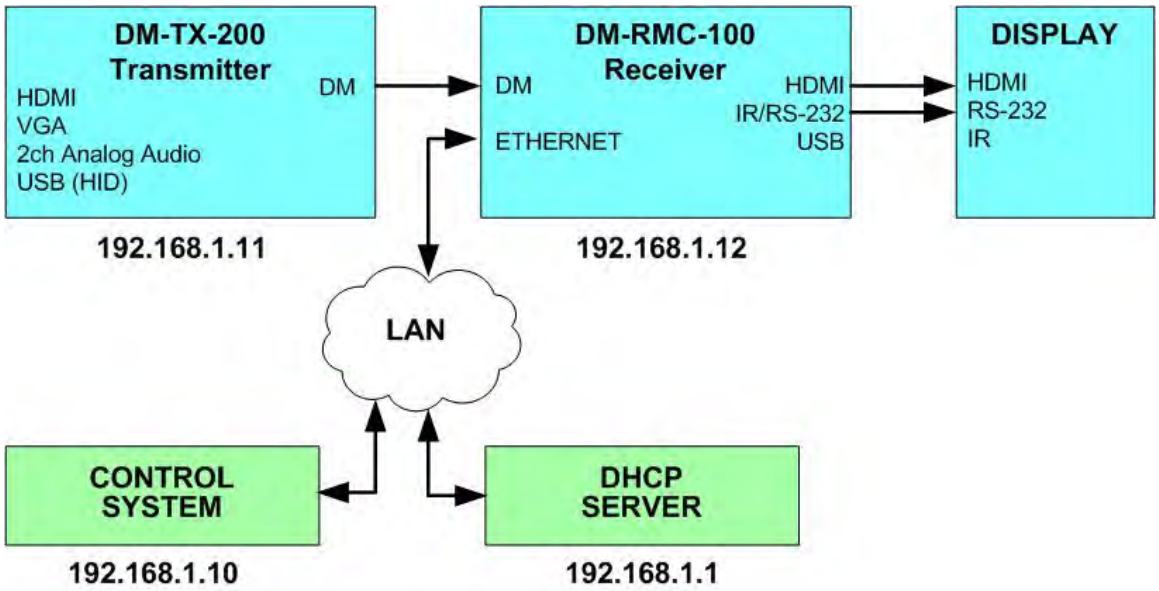
Ethernet Integration

DigitalMedia provides an Ethernet transport method in addition to HDMI, control, and USB HID transport. DigitalMedia carries 10/100 Ethernet to each room controller, supporting streaming media for multimedia devices, or providing LAN connectivity for any room device that requires Ethernet or Internet access. Its Gigabit Ethernet connection to the external LAN helps maximize bandwidth for each network port. Ethernet is also utilized internally by the Crestron control bus to manage all of the DM devices in the system and provide display control in each room.

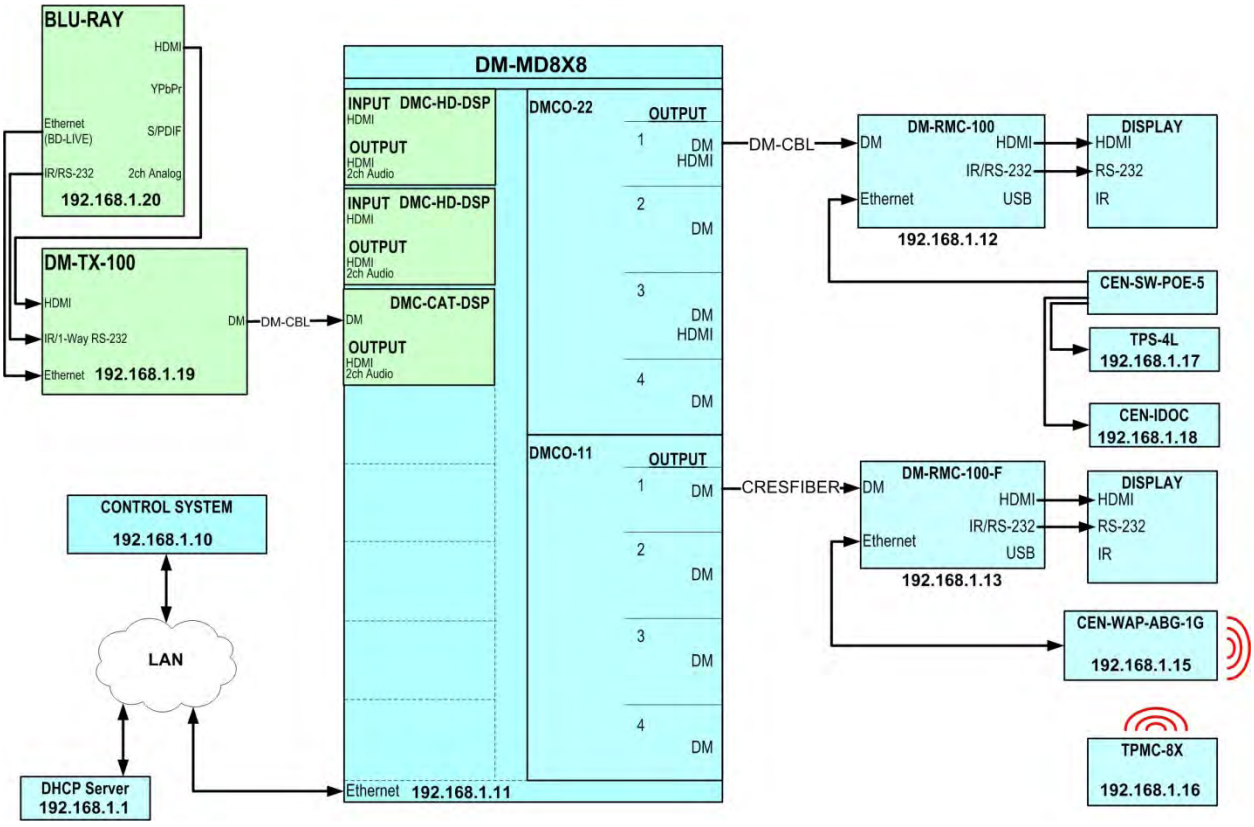
All DM products are Ethernet devices. Ethernet is transported via every DM-CAT, DM 8G, and DM-Fiber connection. When using a DM-MD8X8, DM-MD16X16, DM-MD32X32, or DM-MD6X1 at the core of your system, the Ethernet uplink occurs at the switcher, and Ethernet is distributed to the transmitter(s) or room box (or boxes) via the integrated 10/100 Ethernet switch contained in the switcher, making separate LAN connections unnecessary.

Each DM device (switcher, transmitter, room box) must receive an IP address, via either DHCP (server required) or static assigning.

Point to Point Systems



Switcher Based Systems



DM room boxes (CAT, 8G, and Fiber versions) come fully equipped with an integrated Ethernet switch, and a spare port is provided. In a scenario where the room box is connected to a DM switcher, this port can be used for connecting other Ethernet devices. In a point-to-point scenario, the Ethernet port can be used as an uplink to the main network. For example, if a system contains a DM-TX-200 and a DM-RMC-100, the room box must serve as the uplink point, since the DM-TX-200 does not provide an Ethernet port. But if the DM-TX-200 is replaced with a DM-TX-100 or DM-TX-300, then Ethernet uplink can happen at either of the transmitters or at the room box, since all of these devices have an available Ethernet port.

NOTE: Both Ethernet ports should not be plugged into the same network. The network connection should be via the switcher and not the transmitter or receiver.

The HD-DTDS Specification and Certification

Crestron DigitalMedia was developed to meet the challenges of the digital era. Now, DigitalMedia is rapidly becoming an industry standard with thousands of successful installations. To guarantee the reliable performance of DigitalMedia systems, Crestron has created the HD Digital Transport and Distribution System (HD-DTDS) specification. This new spec establishes an industry standard, and the DM certification program ensures that AV professionals are fully educated and adhere to the standard. This sets a high benchmark for digital AV systems and gives clients the confidence that our industry remains a trusted and valued technology resource.

The HD-DTDS specification is a comprehensive roadmap that clearly defines the critical aspects of system design and installation that must be followed to assure reliable system performance. Crestron guarantees and fully supports any DM system installation that conforms to the HD-DTDS standards.

The complete HD-DTDS specification is available on the Crestron website at www.crestron.com/dmresources.

Crestron offers two levels of certification specific to DigitalMedia.

DM Certified Designer (DMC-D)

The DMC-D track is a free one-day course that concludes with an exam that must be passed to earn certification. It is a prerequisite for DMC-E. A DM Certified Designer understands the fundamental differences between analog and digital systems and the unique design considerations needed to ensure reliable operation. Consultants are widely adopting the HD-DTDS specification and are earning DMC-D certification. Classes are conducted in Crestron regional offices throughout North America. Check the schedule for the next available class near you at www.crestron.com/dmcertification.

DM Certified Engineer (DMC-E)

The DMC-E certification builds upon the DMC-D class. This rigorous three day program details every aspect of system installation and commissioning. DM certified engineers demonstrate proficiency in system setup, diagnostics, testing and reporting. Only a DMC-E is equipped to fully execute and support a DM project. Written into the specification, only dealers with a DMC-E on staff will be qualified to bid on projects designed using the HD-DTDS.

Check the schedule for the next available class near you at www.crestron.com/dmcertification. There is a $1,000 non-waivable registration fee for DMC-E courses. Courses are in high demand, so registration is limited to only two people per company per class. The DMC-E course includes DMC-D certification, so there is no need to register for DMC-D certification.

Design and Install a DigitalMedia System

This section will take you though the four steps to successfully design a Crestron DigitalMedia system. The steps are as follows:

Step 1 – **Selecting Wiring Type.** The choice of cable determines the output cards and room controllers.

Step 2 – **Selecting DigitalMedia Equipment.** Pick the correct switch frame, input and output cards, and distribution boxes.

Step 3 – **Pre-wiring.** Notes and recommendations on system wiring.

Step 4 – **System Commissioning.** How to optimize the system by managing HDCP keys and EDID data.

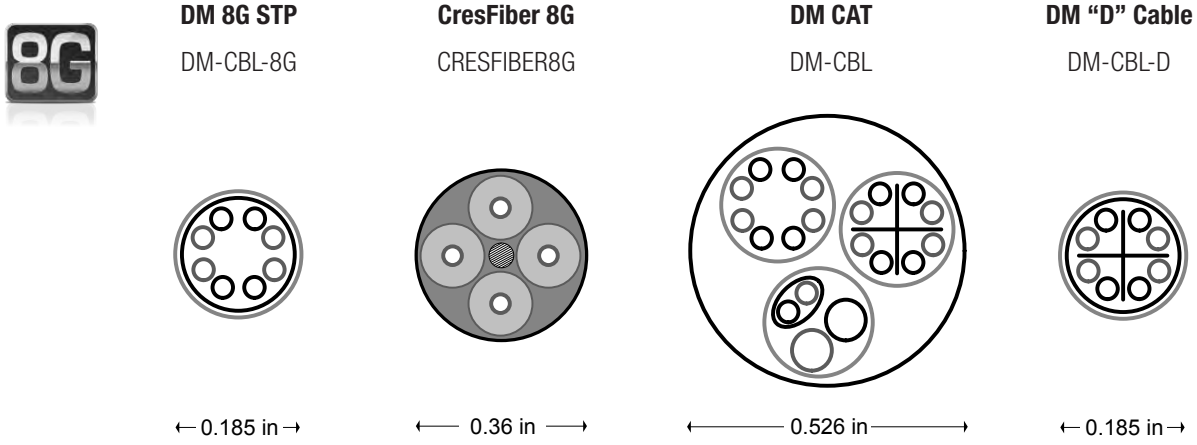
NOTE: The wiring choice depends on your installation, including any pre-existing infrastructure and the run lengths required.

Step 1: Select the Wiring for Each Run

DigitalMedia supports the following wiring options:

1. DigitalMedia 8G Shielded Twisted Pair (DM-CBL-8G)
2. CresFiber® 8G Multimode Fiber (CRESFIBER8G)
3. Third party multimode fiber
4. DigitalMedia CAT (DM-CBL, DM-CBL-D)
5. Add DigitalMedia "D" Cable to a system where CAT5 is already in place. Use for the "D" side of DM.

Cross-Section Comparison of Cables



- One cable run of DM-CBL, DM-CBL-8G, or CRESFIBER8G is required for each DM room controller (DM-RMC) connection (refer to Table A for transmission distance capabilities).
- DigitalMedia CAT supports repeaters (DM-DR) to extend transmission distance.
- The transmission distances between repeaters are determined by the video resolution sent over the wires. The total distance that video can be sent using repeaters is also shown in "Table A - Distances for Original DigitalMedia Devices" for each cable type. Up to two repeaters may be used to extend the transmission distance.
- The DM Fiber and DM 8G solutions do not use repeaters.

Table A - Distances for Original DigitalMedia Devices

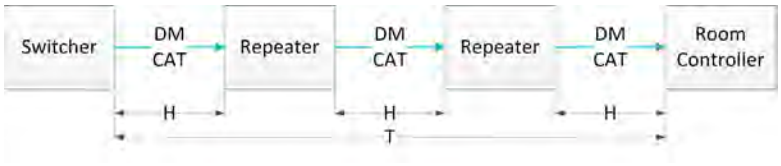
Resolution	DigitalMedia CAT (DM-CBL, DM-CBL-D)		CresFiber® (CRESFIBER)	CresFiber® 8G (CRESFIBER8G)
	H *Distance between repeaters*	**T** *Total distance using up to 2 repeaters*	**T** *Total Distance*	**T** *Total Distance*
1080i / 720p / 1080p 24Hz	200 ft (60 m)	450 ft (137 m)	1000 ft (300 m)	1000 ft (300 m)
1024x768 60Hz	200 ft (60 m)			
1280x1024 60Hz	150 ft (45 m)			
1920x1200 60Hz	150 ft (45 m)			
1080p 60Hz	150 ft (45 m)			
1600x1200 60Hz	125 ft (38 m)	375 ft (114 m)		
1080p 60Hz Deep Color	50 ft (15 m)	150 ft (45 m)		

NOTE: DM-CBL runs must be a minimum of 15 feet; Original DM devices cannot be used with DM-CBL-8G.

DigitalMedia CAT

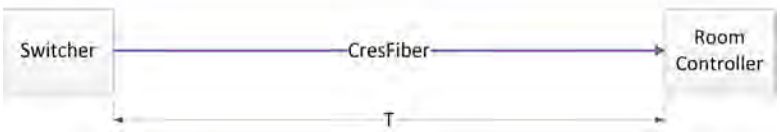
H = Distance between repeaters

T = Total distance using up to two repeaters



CresFiber and CresFiber 8G

Fiber transmission distances are not affected by video resolution, so only a single number for total distance is shown. Unlike the DM CAT solution, no repeaters are used.



What is 8G?

DigitalMedia 8G provides ultra high-speed communications over long distances without a repeater. With DM 8G, the entire uncompressed DigitalMedia signal (Ethernet, HD video, audio, control, USB data) is transmitted over a single fiber or shielded twisted pair cable. The simplified wiring reduces system complexity and installation time. Power can be provided with the PoE standard, replacing the external power supply (see Powering DigitalMedia 8G, page 39).

Look for the 8G label to easily find DigitalMedia 8G products.

Table B - Distances for DigitalMedia 8G Devices

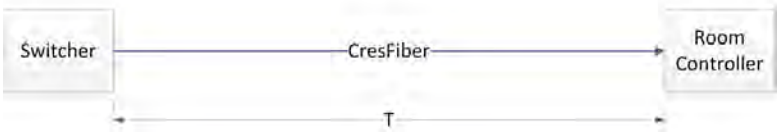
Resolution	DM 8G STP (DM-CBL-8G)	DM Cable (DM-CBL, DM-CBL-D)	CresFiber® 8G (CRESFIBER8G)	CresFiber® (CRESFIBER)
	T *Total Distance*	**T** *Total distance*	**T** *Total Distance*	**T** *Total Distance*
1080i / 720p / 1080p 24Hz	330 ft (100 m)	200 ft (60 m)	1000 ft (300 m)	500 ft (150 m)
1024x768 60Hz				
1280x1024 60Hz				
1920x1200 60Hz				
1080p 60Hz				
1600x1200 60Hz				
1080p 60Hz Deep Color				

DM 8G STP

Unlike original DM devices, no repeaters are used with DM 8G products, regardless of wire type.

CresFiber 8G

Similar to original DM fiber, DM 8G fiber does not require repeaters and resolution does not affect distance.



About Deep Color

Deep Color is an option that was added to HDMI 1.3. It allows devices to transmit video using 36 bits per pixel instead of 24 bits per pixel. This new color depth allows for 4096 shades each of red, green and blue instead of only 256. It is a good concept, but in reality it is unlikely to be available anytime soon. Cable and satellite companies do not have the bandwidth to support transmission of that size. Some Blu-ray players “support” Deep Color, but the Blu-ray standard does not. This means that the content itself is only 24-bit and the player just dithers the colors, providing no real increase in video quality.

Given the lack of support for this feature and the decrease in transmission distances that it entails, Crestron recommends using standard 1080p unless Deep Color is specifically requested.

DigitalMedia Copper Cable Specifications

	DigitalMedia 8G Cable (DM-CBL-8G)	DigitalMedia CAT (DM-CBL)	DigitalMedia "D" Cable (DM-CBL-D)
Outer Diameter (Non-Plenum)	0.244 ± 0.008 in (6.2 ± 0.2 mm)	0.58 in (14.73 mm)	0.3 in (7.62 mm)
Outer Diameter (Plenum)	0.252 ± 0.008 in (6.4 ± 0.2 mm)	0.58 in (14.73 mm)	0.3 in (7.62 mm)
Minimum Bend Radius	2.75 in	4.5 in	3.5 in
Maximum Pull Tension	25 lbf	73 lbf	28 lbf

NOTE: It is recommended to install a pull box at every 90 degree bend to ensure that the DM cable can be put through the conduit with minimal stress to the wire.

About the Cable

DigitalMedia 8G STP

DM 8G STP is ultra-high performance twisted pair wire for connecting DigitalMedia products. DM 8G STP carries the entire DM signal (HD video, audio, Ethernet, and USB) on one thin cable up to 330 feet without repeaters.

- **DM-CBL-8G-NP-SP500** (non-plenum) supplied in 500 ft spools
- **DM-CBL-8G-P-SP500** (plenum) supplied in 500 ft spools

DigitalMedia CAT

This cable is specially engineered by Crestron for DigitalMedia. Up to two patch panels may be used on any DigitalMedia CAT run, but they must use shielded connectors rated for CAT6a. Because the "D" video cable is shielded, it must be terminated using shielded RJ45 connectors provided by Crestron (DM-CONN). These connectors can be terminated without any special tools; all that is needed is a wire cutter/stripper. Refer to Data Sheet Doc. 6767B for additional termination details.
DigitalMedia CAT is available in two versions, plenum and non-plenum:

- **DM-CBL-NP-SP500**
  DigitalMedia CAT - (1) High bandwidth/low crosstalk shielded 4-twisted-pair, (1) CAT5e, and (1) DMNet control cable; non-plenum, 500 ft spool
- **DM-CBL-P-SP500**
  DigitalMedia CAT - (1) High bandwidth/low crosstalk shielded 4-twisted-pair, (1) CAT5e, and (1) DMNet control cable; plenum-rated, 500 ft spool

DigitalMedia "D" Cable

Use DigitalMedia "D" Cable to upgrade existing QM systems where CRESCAT-QM is already in place. DM "D" Cable is also useful in conduit where you need to pull the three DM cables separately because the diameter of a single jacket is too large.

- **DM-CBL-D-NP-SP500** (non-plenum) supplied in 500 ft spools
- **DM-CBL-D-P-SP500** (plenum) supplied in 500 ft spools

NOTE: Transmission distance is limited to 200 feet max when using DM-CBL or DM-CBL-D to transport DM 8G signals. See "Table B - Distances for DigitalMedia 8G Devices" on page 16 for more details.

CresFiber® 8G

Crestron makes available a multimode fiber solution for DigitalMedia. CresFiber 8G contains four strands of 50 micron multimode fiber for long distance transmission inside a single jacket. Two strands are used with original DigitalMedia devices and the other two strands are available for redundancy and expansion. When using with DM 8G Fiber devices, one strand is used for DigitalMedia and three strands are for redundancy and expansion.

CresFiber 8G is easy to run and terminate for cable runs that are 300m (1000 ft) or less, and it is highly recommended for these applications. It contains four fiber strands in a "breakout" cable formation; each strand has its own 3mm jacket with strength members inside. This gives it the ability to be terminated directly to the SC connector, without requiring a breakout kit, because each strand can support a large amount of tension.

- **CRESFIBER8G-NP:** CresFiber fiber optic breakout cable: (4) 50/125 multimode fiber strands available in 500 ft and 1000 ft spools.
- **CRESFIBER8G-P:** Plenum-rated version available in 500 ft and 1000 ft spools.
- See "Appendix D: Crestron Certified Cables" on page 64 for pre-terminated CresFiber models

NOTE: CRESFIBER has been replaced by CRESFIBER8G in the Crestron catalog as of December 2010.

Fiber Termination

CRESFIBER-TK Termination Kit

DigitalMedia fiber devices use two standard SC multimode connectors for each signal (DigitalMedia 8G devices only need one). Termination of CresFiber cable can be accomplished in under 10 minutes per connector using Crestron CRESFIBER-CONN-SC50UM connectors and the CRESFIBER-TK termination kit.

The kit includes everything necessary to cut, prepare, clean, and terminate the fiber. An instructional DVD also accompanies the kit to show proper fiber handling and termination.

Selecting Third-Party Fiber (advanced)

Picking the correct fiber cabling for your application is a function of distance and the physical location of the cable. The optical fiber (the part that carries the optical signal) determines the distance, and the jacket configuration depends on the application (i.e. plenum, outdoor rating, number of fibers, etc). Either 50u or 62.5u multimode fiber may be used so long as the bandwidth of the fiber is sufficient.

If CresFiber 8G cannot be used, OM3 rated fiber may be substituted for applications using original DM fiber and DM 8G fiber devices. If OM3 is unavailable, see the bandwidth calculations in the next section for more options. The following section applies only to DM Fiber applications and is *not* for DM 8G Fiber applications.

NOTE: DM 8G fiber signals can be carried a maximum of 500 ft using standard OM3 fiber.

Fiber Bandwidth

NOTE: Only for applications using original DM fiber devices (models with "-F" suffix). Not for applications using DM 8G fiber devices (models with "-S" suffix).

Your selection of fiber cabling must have enough bandwidth to carry the DigitalMedia signals. The bandwidth of multimode fiber is inversely proportional to the length of the fiber, because of the way multimode fiber works. The bandwidth of the fiber is measured in Effective Modal Bandwidth (EMB), or MHz*km. For example, a 500MHz*km fiber can carry a 500MHz signal 1km, or a 250MHz signal 2km. Each fiber cable also has a different EMB rating at the two commonly used multimode wavelengths, 850nm and 1300nm.

NOTE: The bandwidth of fiber cables are calculated based on several different standards put out by the TIA/EIA. This is because the bandwidths vary slightly, depending on whether the light source is a laser or LED. DigitalMedia is a laser-based fiber system, so the laser bandwidth should be used. This is sometimes referred to as RML BW (restricted mode launch bandwidth) or EMBc (Effective Modal Bandwidth calculated).

The calculations must be done at both wavelengths to ensure there is enough bandwidth for each. The DigitalMedia application requires the following bandwidth over fiber:

1200MHz @ 850nm

150MHz @ 1300nm

To calculate the distance that a DigitalMedia fiber transmission can be run, divide the bandwidth rating of the fiber by the DigitalMedia bandwidth. Consider the following examples:

Example 1

Corning® infiniCor600® has the following bandwidth ratings: 500MHz*km @ 850nm and 500MHz*km @ 1300nm.
How far can you send DigitalMedia over that fiber?

850nm: 500MHz*km / 1200MHz = 416m (1365 ft)

1300nm: 500MHz*km / 150MHz = 3.3km (10,826 ft)

NOTE: Regardless of calculation results, 1,000 ft (300 m) is the maximum distance the DM signal can be transmitted.

This fiber is able to drive DigitalMedia up to 416m (1365 ft). If you know the distance and need to determine which fiber will work, you can also multiply the DigitalMedia bandwidth by the distance to find the minimum fiber bandwidth.

Example 2

I need to send DigitalMedia over fiber 300m. What is the bandwidth requirement for my fiber cable?

850nm: 1200MHz * 300m = 360MHz*km

1300nm: 150MHz * 300m = 45MHz*km

Corning infiniCor600 supports 500MHz*km at both wavelengths, therefore it is an acceptable fiber type for this installation.

Selecting the Jacket Configuration

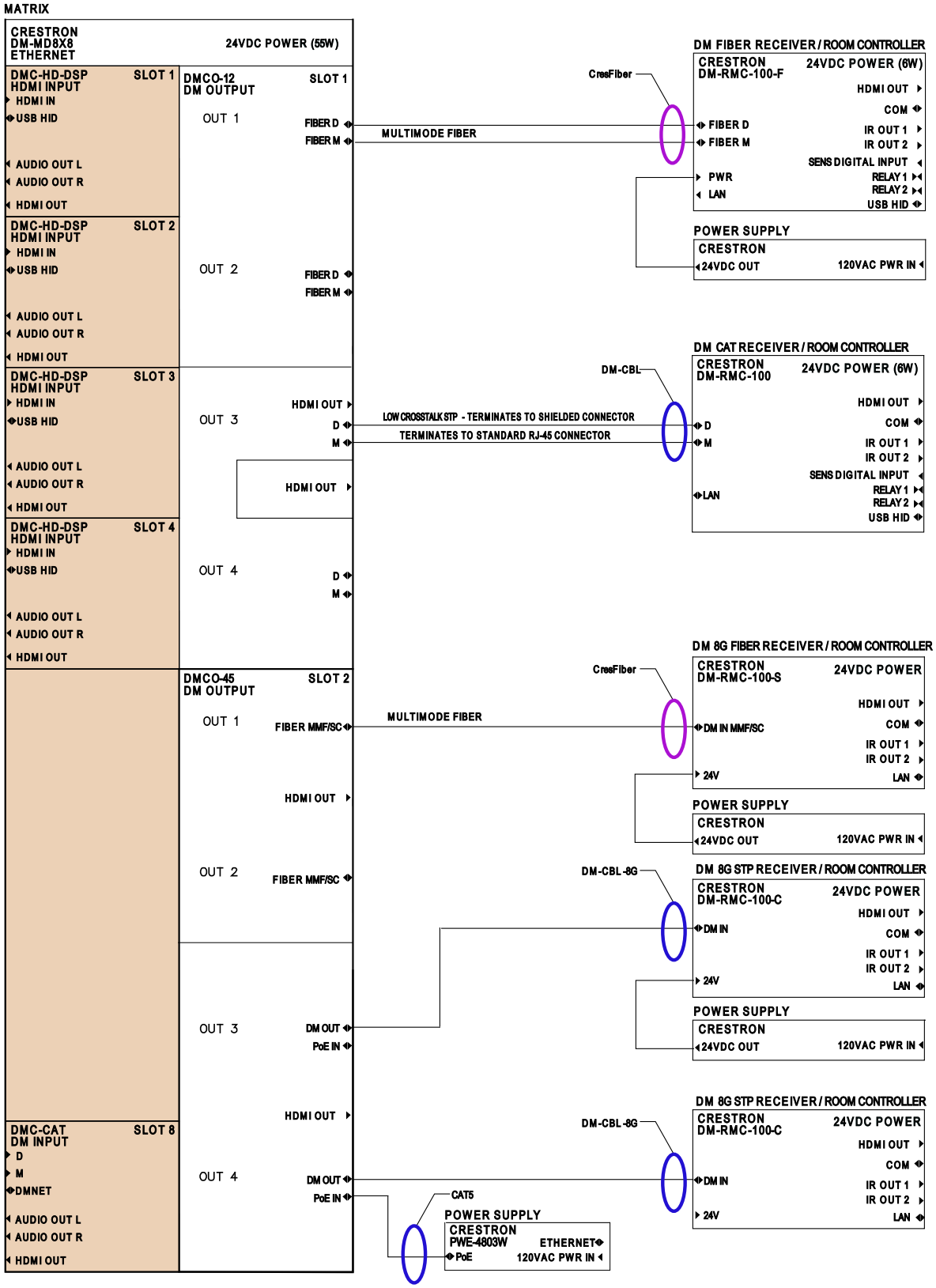
When using fiber, it is recommended that you have at least two spare fibers for each location; a minimum of four strands in your fiber jacket should be run to each endpoint. Ensure that your fiber cable has the correct ratings for your installation (i.e. plenum, outdoor, UL, etc). Crestron recommends using a breakout type cable system for basic installations, because the fibers can be directly terminated to the DigitalMedia equipment.

Minimum Fiber Optic Cable Bending Radius

Loaded: 20 x Diameter (0.313 in) = 6.26 in
Unloaded: 10 x Diameter (0.313 in) = 3.13 in

Wiring Example

An example of copper and fiber room controller wiring connections to a DM-MD8X8 Switcher.



Step 2: Select DigitalMedia Equipment

Switcher Chassis

There are three DigitalMedia switcher card frames available: DM-MD8X8, DM-MD16X16, and DM-MD32X32. Each switcher permits inputs to be cascaded with up to four additional switchers, increasing the number of available outputs in the system while maintaining HDCP compliance. For example, using five DM-MD16X16 switchers in a system will provide a total of 80 available outputs. Even more switchers can be cascaded for applications that do not require HDCP support. Available output card configurations are explained later in this guide.

- Input and output cards must be selected upon time of order
- Switchers will ship pre-loaded with your custom configuration
- DM-MD8X8 and DM-MD32X32: input and output cards may be added and reconfigured in the field
- DM-MD16X16: only input cards may be added and reconfigured in the field; output cards must be added or configured by Crestron

NOTES:

1. DisplayPort Multimode connectivity is supported via an HDMI or DVI input port using a suitable adapter or interface cable (not included).
2. For external DMNet power, use a Crestron CNPWS-75, C2N-SPWS300, or other Cresnet power supply as required.
3. DMNet uses the same physical connectors as Cresnet, but the two protocols are not compatible. Be sure you do not cross-wire DMNet and Cresnet.
4. The EIG connector on the DM product switchers is used to jumper in external power (in the same manner as the PAC2). See the power and heat calculations on page 39.
5. DigitalMedia 8G does not use DMNet power. See page 39 for details on powering DM 8G.

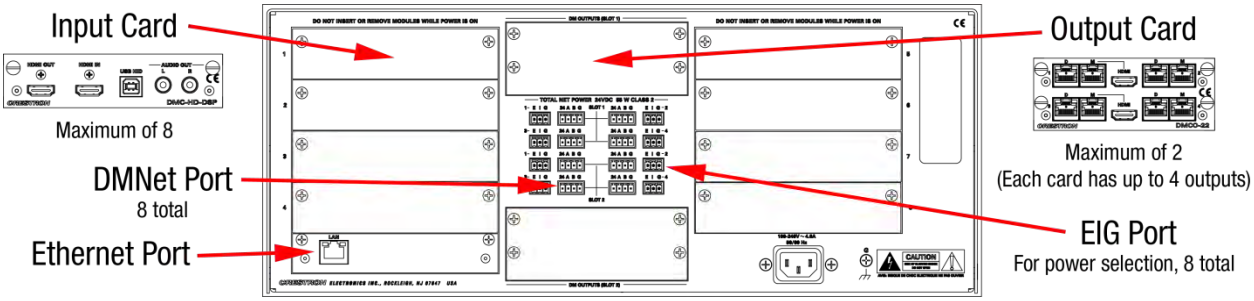
What is RPS?

All three DigitalMedia switcher card frames are available with a redundant power supply, denoted by "-RPS" at the end of the model name. With the RPS option, in the event one of the power supplies should fail, the unit will continue to operate as normal. The DM-MD8X8-RPS, DM-MD16X16-RPS and DM-MD32X32-RPS have an MTBF (Mean Time Between Failures) of 1,000,000 hours.

NOTE: RPS models do not provide DMNet power internally. Instead, DMNet power must be provided by external power supplies like CNPWS-75 and C2N-SPWS300.

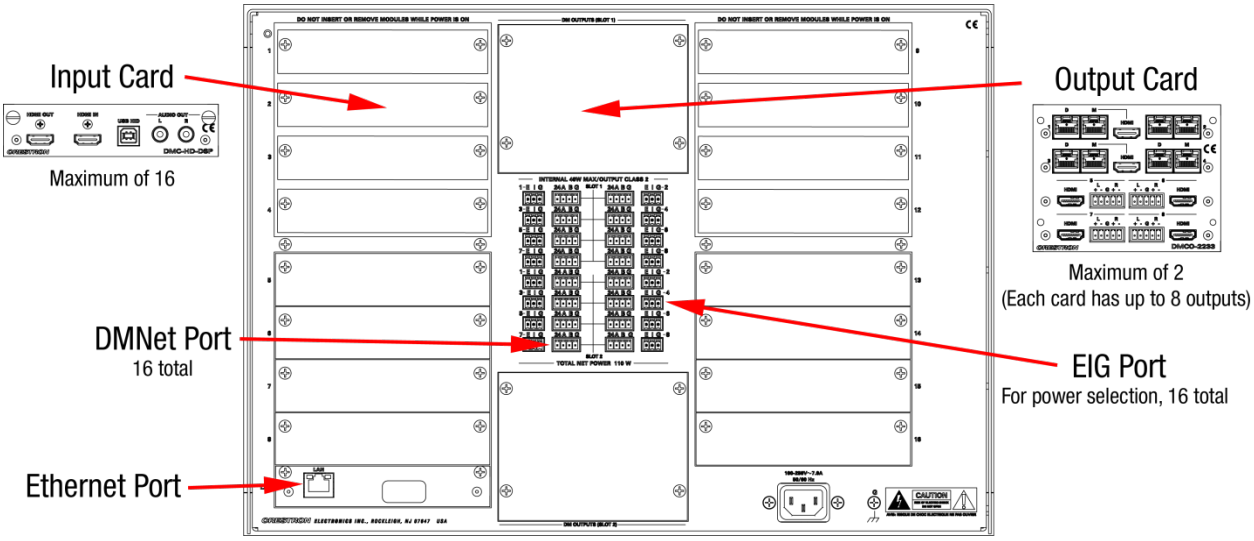
DM-MD8X8 and DM-MD8X8-RPS

- Eight input card slots (field upgradable) for up to eight AV sources
- Eight DM room outputs and/or HDMI outputs; up to 40 outputs using multiple chassis
- Two DMCO-xx type output cards; field upgradeable
- Full audio and USB breakaway
- DM-MD8X8-RPS has an internal redundant power supply for utmost reliability (MTBF of 1,000,000 hours)



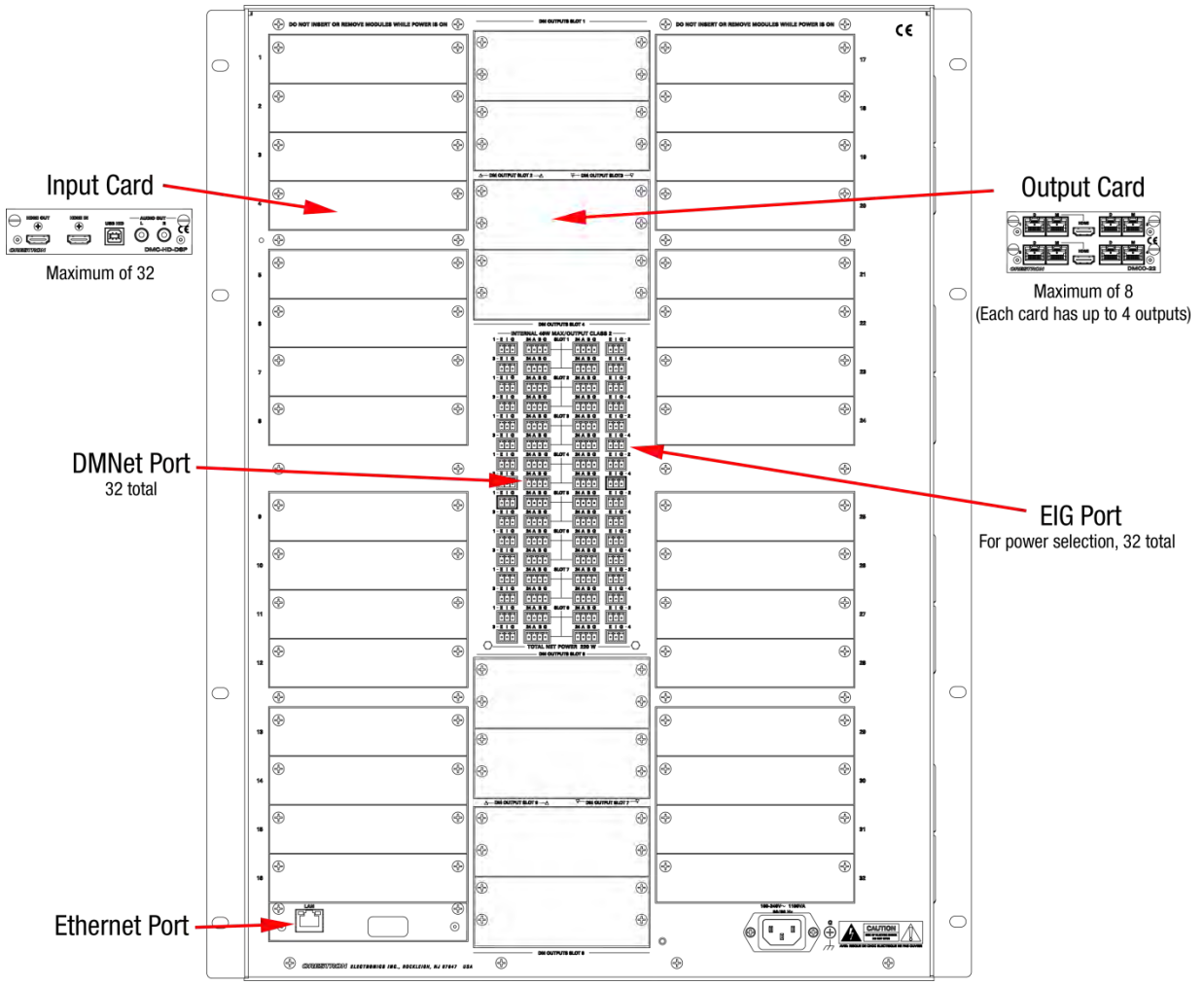
DM-MD16X16 and DM-MD16X16-RPS

- 16 input card slots (field upgradeable) for up to 16 AV sources
- 16 DM room outputs and/or HDMI outputs; up to 80 outputs using multiple chassis
- Two DMCO-xxxx type output cards; factory installed
- Full audio and USB breakaway
- DM-MD16X16-RPS has an internal redundant power supply for utmost reliability (MTBF of 1,000,000 hours)



DM-MD32X32 and DM-MD32X32-RPS

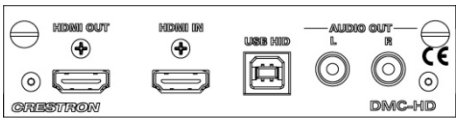
- 32 input card slots (field upgradeable) for up to 32 AV sources
- 32 DM room outputs and/or HDMI outputs; up to 160 outputs using multiple chassis
- Eight DMCO-xx type output cards; field upgradeable
- Full audio and USB breakaway
- 14-space 19-inch rack-mountable
- DM-MD32X32-RPS has 3 power supplies (2 required for operation) for utmost reliability (MTBF of 1,000,000 hours)



DigitalMedia Switcher Input Cards - Local Sources

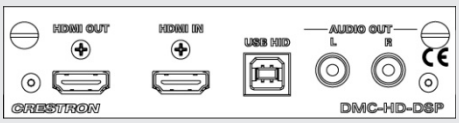
All input cards provide an HDMI loop output for switcher expansion.

DMC-HD



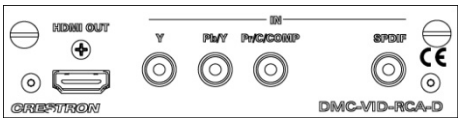
Includes HDMI input, RCA analog audio output (which breaks out the embedded HDMI audio to feed a multi-room audio distribution system), and USB HID port (passes a remote mouse/keyboard signal to the source device, i.e. computer, game console, etc.).

DMC-HD-DSP



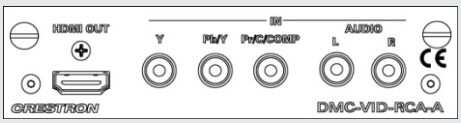
Includes HDMI input, RCA analog audio output (which breaks out the embedded HDMI audio to feed a multi-room audio distribution system), and USB HID port (passes a remote mouse/keyboard signal to the source device, i.e. computer, game console, etc.), plus internal DSP processing to simultaneously provide both uncompressed 7.1 channel HD surround sound and 2-channel audio for distribution via the RCA analog audio output, HDMI, and DigitalMedia.

DMC-VID-RCA-D



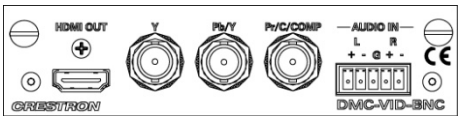
Includes multi-format RCA inputs supporting component, S-video, and composite video signals. Also includes SPDIF digital audio input.

DMC-VID-RCA-A



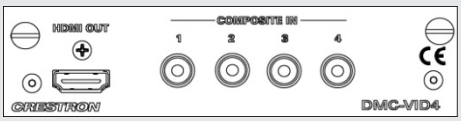
Includes multi-format RCA inputs supporting component, S-video, and composite video signals. Also includes RCA analog audio input.

DMC-VID-BNC



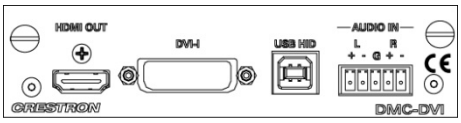
Includes multi-format BNC inputs supporting component, S-video, composite video signals, and balanced or unbalanced stereo audio.

DMC-VID4



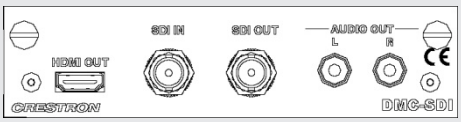
Includes four RCA composite video inputs w/built-in sequential switcher and quad processor. Supports dynamic colored text overlay on all four video windows for easy identification.

DMC-DVI



Includes DVI-I input supporting DVI, RGBHV, component, S-video, and composite video signals. Also includes balanced or unbalanced stereo audio input and USB HID port.

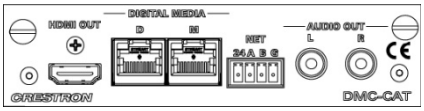
DMC-SDI



Includes support for SD-SDI, HD-SDI and 3G-SDI (1080p/60), while providing an SDI loop-thru connector. Also includes support for extracting embedded audio from any of the eight channels.

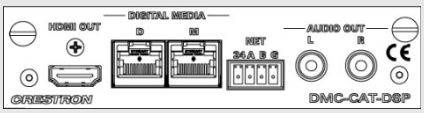
DigitalMedia Switcher Input Cards - Remote Sources

DMC-CAT



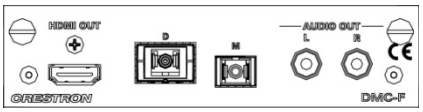
Receives a DigitalMedia signal from a DigitalMedia transmitter via DM CAT. Includes DigitalMedia input ports, and RCA analog audio output to break out audio embedded in the DigitalMedia signal.

DMC-CAT-DSP



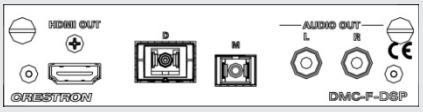
Receives a DigitalMedia signal from a DigitalMedia transmitter via DM CAT. Internal DSP processing enables simultaneous 7.1 and 2-channel audio output.

DMC-F



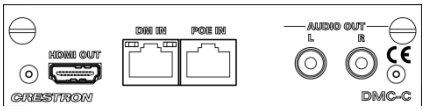
Receives a DM signal from a DM transmitter via CresFiber or multimode optical fiber cable. Includes DigitalMedia fiber input and RCA analog audio output.

DMC-F-DSP



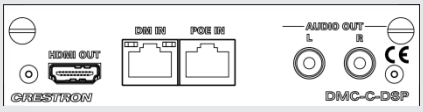
Receives a DM signal from a DM transmitter via CresFiber or multimode optical fiber cable. Internal DSP processing enables simultaneous 7.1 and 2-channel audio output.

DMC-C



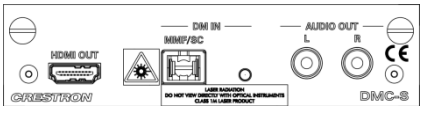
Receives a DigitalMedia signal from a DigitalMedia 8G transmitter via DM 8G STP. Includes DM 8G STP input, PoE input, and RCA analog audio output to break out audio embedded in the DigitalMedia signal. See Power and Heat section for more info on PoE.

DMC-C-DSP



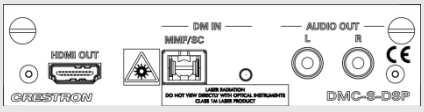
Receives a DigitalMedia signal from a DigitalMedia 8G transmitter via DM 8G STP. Internal DSP processing enables simultaneous 7.1 and 2-channel audio output. See Power and Heat section for more info on PoE.

DMC-S



Receives a DigitalMedia signal from a DigitalMedia 8G transmitter via a single fiber. Includes DM 8G Fiber input and RCA analog audio output to break out audio embedded in the DigitalMedia signal.

DMC-S-DSP



Receives a DigitalMedia signal from a DigitalMedia 8G transmitter via a single fiber. Internal DSP processing enables simultaneous 7.1 and 2-channel audio output.

NOTE: USB HID is a device class, a standard application programming interface (API), which allows devices to communicate without special drivers. We use the terms “device” port and “host” port – although communication flows both ways, the important command flow of keyboard strokes, mouse output, etc. goes from the device to the host. The square, type “B” connector on the DM input cards is considered a host port because it connects to the host, and the DM room controller has a rectangular type “A” device port for the same reason.

For more information on the USB devices supported by DigitalMedia, please go to www.crestron.com/onlinehelp, Answer ID 5007.

Output Cards

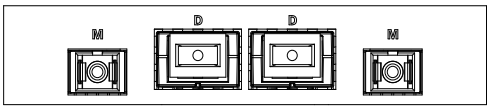
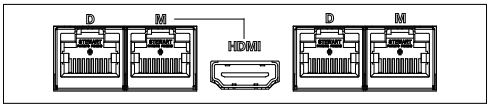
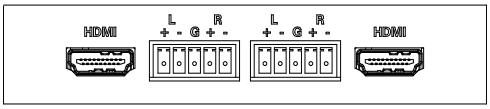
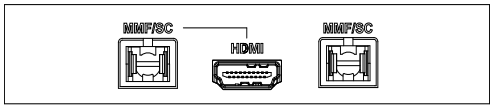
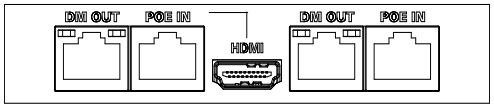
A complete selection of cards is offered to allow numerous combinations of DM (DigitalMedia) and HDMI outputs on a single DM-MD chassis.

DM CAT, DM 8G STP, DM Fiber, DM 8G Fiber, and HDMI with analog audio output types are available. For the DM CAT, DM 8G STP, and DM 8G Fiber outputs, every other output is accompanied by an HDMI output configured in parallel with the DM output. This HDMI output carries the same audio and video signals as its companion DM output, perfect for simultaneously feeding a centralized audio processor via HDMI and a remote display device via DM.

Online Configuration – A convenient on-line program is available to make switcher system configuration simple: www.crestron.com/dmconfiguration

Configuring the DMCO Cards

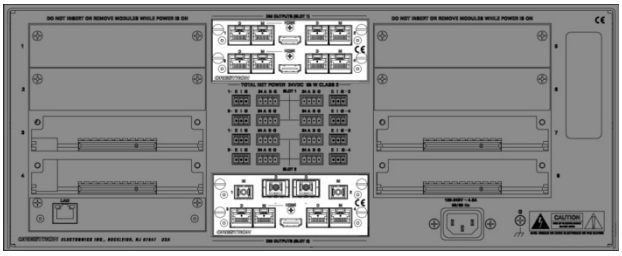
DigitalMedia output cards (DMCO) are configured by assembly. There are five types of cards.

Type 1	Dual DM Fiber Output	
Type 2	Dual DM CAT Output with HDMI	
Type 3	Dual HDMI Output with Dual Balanced Analog Audio	
Type 4	Dual DM 8G Fiber Output with HDMI	
Type 5	Dual DM 8G STP Output with HDMI	

Each DMCO output card has two, four, six or eight outputs. The DM-MD8X8 can hold two (2) DMCO-xx (must use a 2-digit DMCO), while the DM-MD16X16 can hold two (2) DMCO-xxxx (must use a 4-digit DMCO), where the "x" is a placeholder for the card type (1, 2, 3, 4, 5 or 0). The DM-MD32X32 can hold (8) DMCO-xx (must use a 2-digit DMCO).

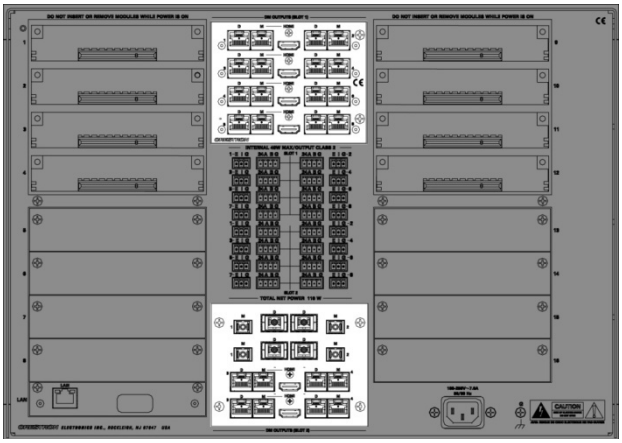
NOTE: A zero (0) in the part name corresponds to a blank slot.

DM-MD8X8



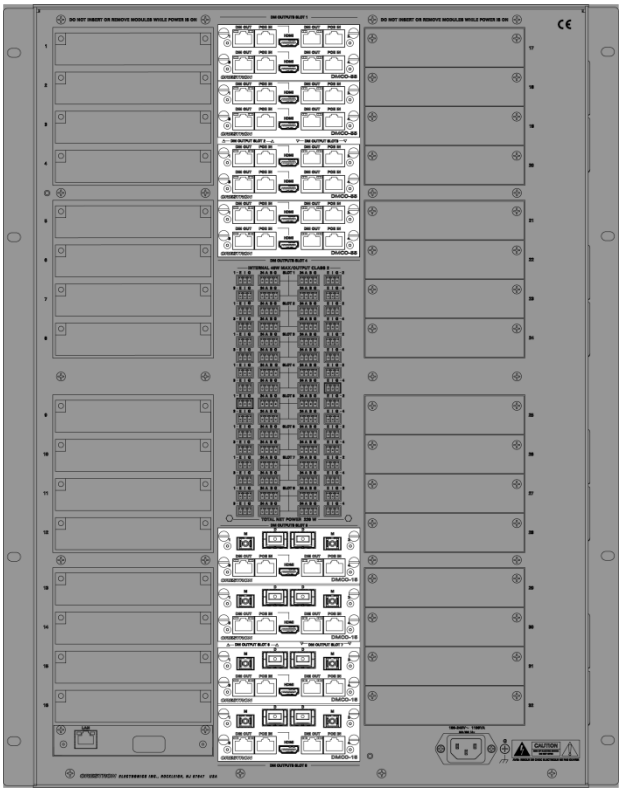
The DM-MD8X8 holds two DMCO-xx type output cards.

DM-MD16X16



The DM-MD16X16 holds two DMCO-xxxx type output cards.

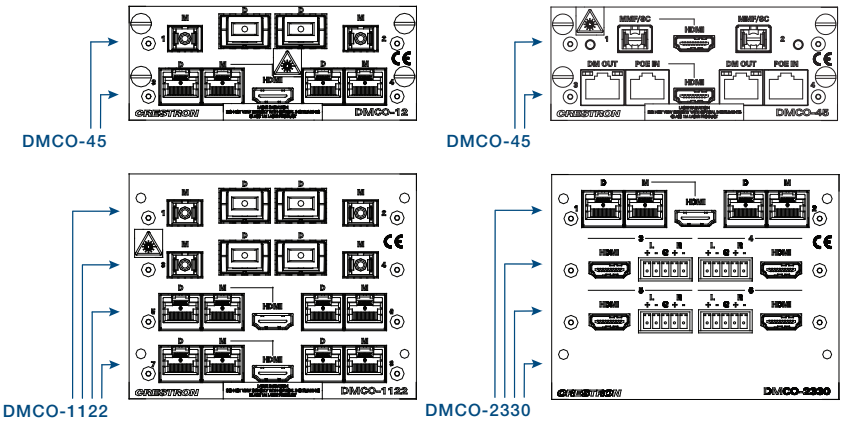
DM-MD32X32



The DM-MD32X32 holds eight DMCO-xx type output cards

Online Configuration – A convenient on-line program is available to make switcher system configuration simple: www.crestron.com/dmconfiguration

DMCO Examples



NOTE: A blank output board corresponds to the number 0 (zero).

DM-MD8X8 and DM-MD32X32 Output Cards

Output Card	DM Fiber Outputs Type 1	DM CAT with HDMI Outputs Type 2	HDMI with Stereo Audio Outputs Type 3	DM 8G Fiber with HDMI Outputs Type 4	DM 8G STP with HDMI Outputs Type 5
DMC0-10	2 DM Fiber				
DMC0-11	4 DM Fiber				
DMC0-12	2 DM Fiber	2 DM CAT & 1 HDMI			
DMC0-13	2 DM Fiber		2 HDMI & 2 Stereo		
DMC0-15	2 DM Fiber				2 8G STP & 1 HDMI
DMC0-20		2 DM CAT & 1 HDMI			
DMC0-22		4 DM CAT & 2 HDMI			
DMC0-23		2 DM CAT & 1 HDMI	2 HDMI & 2 Stereo		
DMC0-30			2 HDMI & 2 Stereo		
DMC0-33			4 HDMI & 4 Stereo		
DMC0-40				2 8G Fiber & 1 HDMI	
DMC0-43			2 HDMI & 2 Stereo	2 8G Fiber & 1 HDMI	
DMC0-44				4 8G Fiber & 2 HDMI	
DMC0-45				2 8G Fiber & 1 HDMI	2 8G STP & 1 HDMI
DMC0-50					2 8G STP & 1 HDMI
DMC0-53			2 HDMI & 2 Stereo		2 8G STP & 1 HDMI
DMC0-55					4 8G STP & 2 HDMI

DM-MD16X16 Factory-Installed Output Cards

Output Card	DM Fiber Outputs Type 1	DM CAT with HDMI Outputs Type 2	HDMI with Stereo Audio Outputs Type 3	DM 8G Fiber with HDMI Outputs Type 4	DM 8G STP with HDMI Outputs Type 5
DMC0-1000	2 DM Fiber				
DMC0-1100	4 DM Fiber				
DMC0-1110	6 DM Fiber				
DMC0-1111	8 DM Fiber				
DMC0-2100	2 DM Fiber	2 DM CAT & 1 HDMI			
DMC0-1220	2 DM Fiber	4 DM CAT & 2 HDMI			
DMC0-2221	2 DM Fiber	6 DM CAT & 3 HDMI			
DMC0-1120	4 DM Fiber	2 DM CAT & 1 HDMI			
DMC0-1122	4 DM Fiber	4 DM CAT & 2 HDMI			
DMC0-1112	6 DM Fiber	2 DM CAT & 1 HDMI			
DMC0-1300	2 DM Fiber		2 HDMI & 2 Stereo		
DMC0-1330	2 DM Fiber		4 HDMI & 4 Stereo		
DMC0-1333	2 DM Fiber		6 HDMI & 6 Stereo		
DMC0-1130	4 DM Fiber		2 HDMI & 2 Stereo		
DMC0-1133	4 DM Fiber		4 HDMI & 4 Stereo		
DMC0-1113	6 DM Fiber		2 HDMI & 2 Stereo		
DMC0-1550	2 DM Fiber				4 8G STP & 2 HDMI
DMC0-1150	4 DM Fiber				2 8G STP & 1 HDMI
DMC0-1155	4 DM Fiber				4 8G STP & 2 HDMI
DMC0-1115	6 DM Fiber				2 8G STP & 1 HDMI

DMCO-2000		2 DM CAT & 1 HDMI			
DMCO-2200		4 DM CAT & 2 HDMI			
DMCO-2220		6 DM CAT & 3 HDMI			
DMCO-2222		8 DM CAT & 4 HDMI			
DMCO-2300		2 DM CAT & 1 HDMI	2 HDMI & 2 Stereo		
DMCO-2330		2 DM CAT & 1 HDMI	4 HDMI & 4 Stereo		
DMCO-2333		2 DM CAT & 1 HDMI	6 HDMI & 6 Stereo		
DMCO-2230		4 DM CAT & 2 HDMI	2 HDMI & 2 Stereo		
DMCO-2233		4 DM CAT & 2 HDMI	4 HDMI & 4 Stereo		
DMCO-2223		6 DM CAT & 3 HDMI	2 HDMI & 2 Stereo		
DMCO-3000			2 HDMI & 2 Stereo		
DMCO-3300			4 HDMI & 4 Stereo		
DMCO-3330			6 HDMI & 6 Stereo		
DMCO-3333			8 HDMI & 8 Stereo		
DMCO-4000				2 8G Fiber & 1 HDMI	
DMCO-4300			2 HDMI & 2 Stereo	2 8G Fiber & 1 HDMI	
DMCO-4330			4 HDMI & 4 Stereo	2 8G Fiber & 1 HDMI	
DMCO-4333			6 HDMI & 6 Stereo	2 8G Fiber & 1 HDMI	
DMCO-4400				4 8G Fiber & 2 HDMI	
DMCO-4430			2 HDMI & 2 Stereo	4 8G Fiber & 2 HDMI	
DMCO-4433			4 HDMI & 4 Stereo	4 8G Fiber & 2 HDMI	
DMCO-4440				6 8G Fiber & 3 HDMI	
DMCO-4443			2 HDMI & 2 Stereo	6 8G Fiber & 3 HDMI	
DMCO-4444				8 8G Fiber & 4 HDMI	
DMCO-5000					2 8G STP & 1 HDMI
DMCO-5300			2 HDMI & 2 Stereo		2 8G STP & 1 HDMI
DMCO-5330			4 HDMI & 4 Stereo		2 8G STP & 1 HDMI
DMCO-5333			6 HDMI & 6 Stereo		2 8G STP & 1 HDMI
DMCO-5400				2 8G Fiber & 1 HDMI	2 8G STP & 1 HDMI
DMCO-5440				4 8G Fiber & 2 HDMI	2 8G STP & 1 HDMI
DMCO-5444				6 8G Fiber & 3 HDMI	2 8G STP & 1 HDMI
DMCO-5500					4 8G STP & 2 HDMI
DMCO-5530			2 HDMI & 2 Stereo		4 8G STP & 2 HDMI
DMCO-5533			4 HDMI & 4 Stereo		4 8G STP & 2 HDMI
DMCO-5540				2 8G Fiber & 1 HDMI	4 8G STP & 2 HDMI
DMCO-5544				4 8G Fiber & 2 HDMI	4 8G STP & 2 HDMI
DMCO-5550					6 8G STP & 3 HDMI
DMCO-5551	2 DM Fiber				6 8G STP & 3 HDMI
DMCO-5553			2 HDMI & 2 Stereo		6 8G STP & 3 HDMI
DMCO-5554				2 8G Fiber & 1 HDMI	6 8G STP & 3 HDMI
DMCO-5555					8 8G STP & 4 HDMI

NOTE: The DMCO cards for the DM-MD16X16 are factory installed and configured.

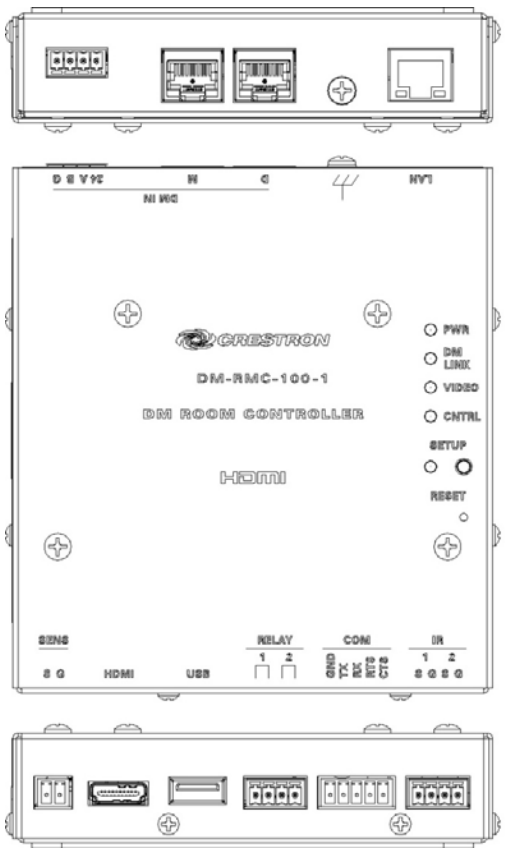
DigitalMedia Room Controllers

Room controllers provide the connection between the DM signal and output devices such as a television. The table below lists the features for each model. All room controllers feature a low profile design, perfect for installation behind flat panel displays and above ceiling mounted projectors. The included external power supply should be used with the DM-RMC-100-F, DM-RMC-100-C, DM-RMC-200-C, DM-RMC-100-S, and DM-RMC-150-S.

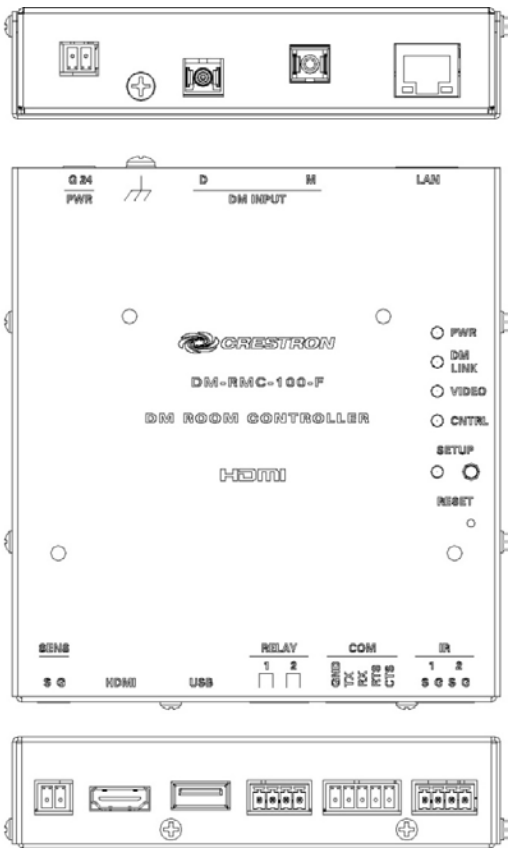
Feature Comparison

Model Name	DM-RMC-100-1	DM-RMC-100-F	DM-RMC-100-C	DM-RMC-200-C	DM-RMC-100-S	DM-RMC-150-S
DM Communication	DM CAT	DM Fiber	DM 8G STP	DM 8G STP	DM 8G Fiber	DM 8G Fiber
Output Video Types	HDMI or DVI	HDMI or DVI	HDMI or DVI	HDMI or DVI	HDMI or DVI	HDMI or DVI
Output Audio Types	HDMI	HDMI	HDMI	HDMI or Analog	HDMI	HDMI or Analog
Stereo Amplifier	-	-	-	30 Watts	-	-
IR Ports	2	2	2	2	2	2
COM Ports	1	1	1	1	1	1
Ethernet	Yes	Yes	Yes	Yes	Yes	Yes
Power Supply	-	Included	Included	Included	Included	Included
USB Port	Yes	Yes	-	Yes	-	Yes
Relays	2	2	-	2	-	2
Contact Sensing Input	1	1	-	1	-	1
Mounting	Surface mount	Surface mount	Surface mount	2-gang wall box	Surface mount	Surface mount

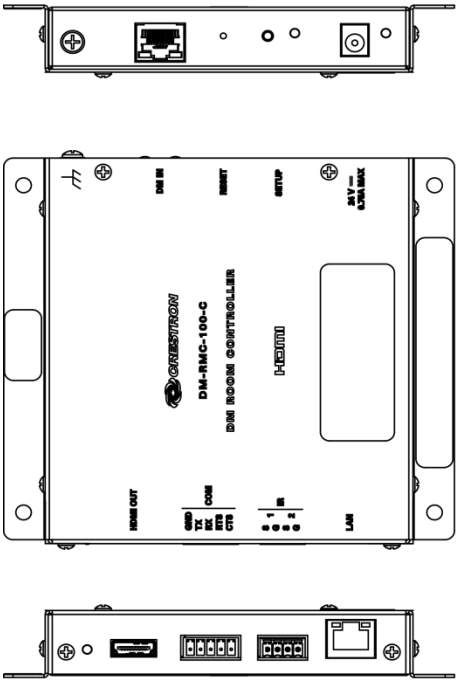
DM-RMC-100-1



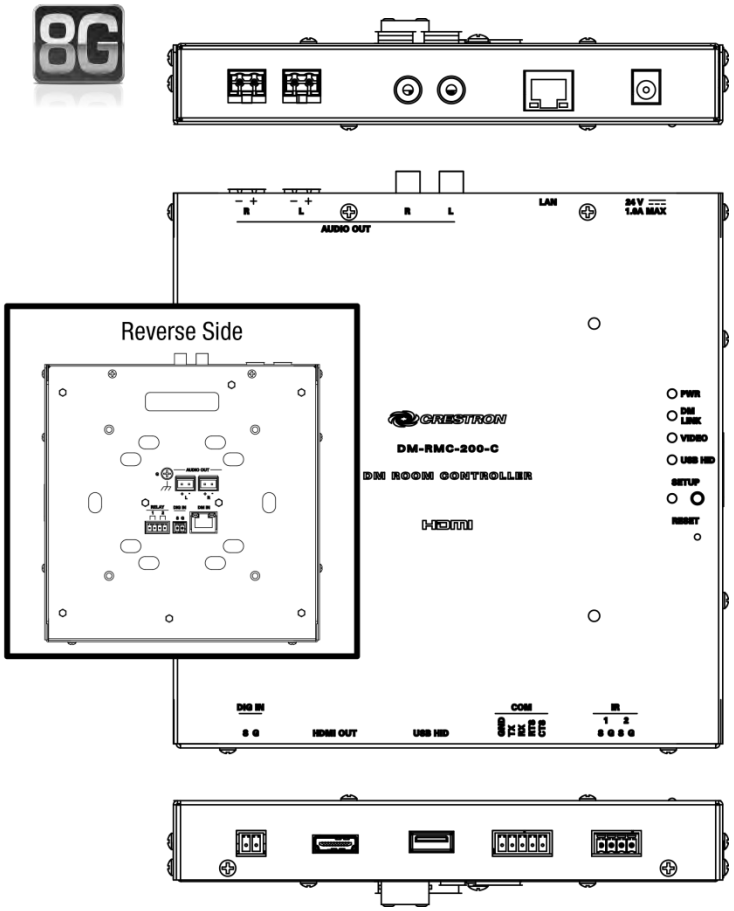
DM-RMC-100-F



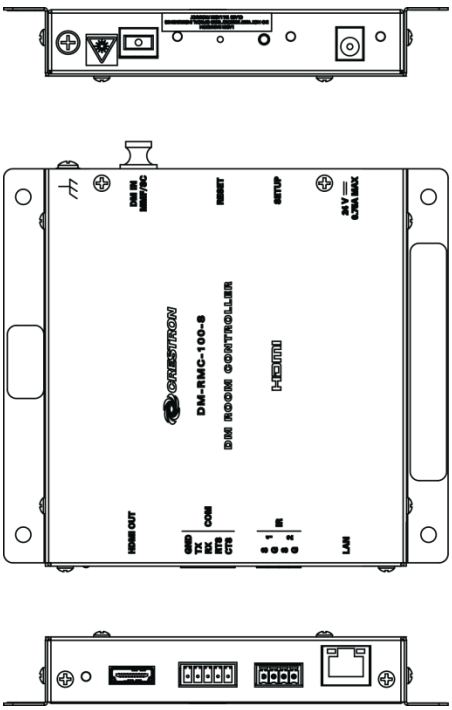
DM-RMC-100-C



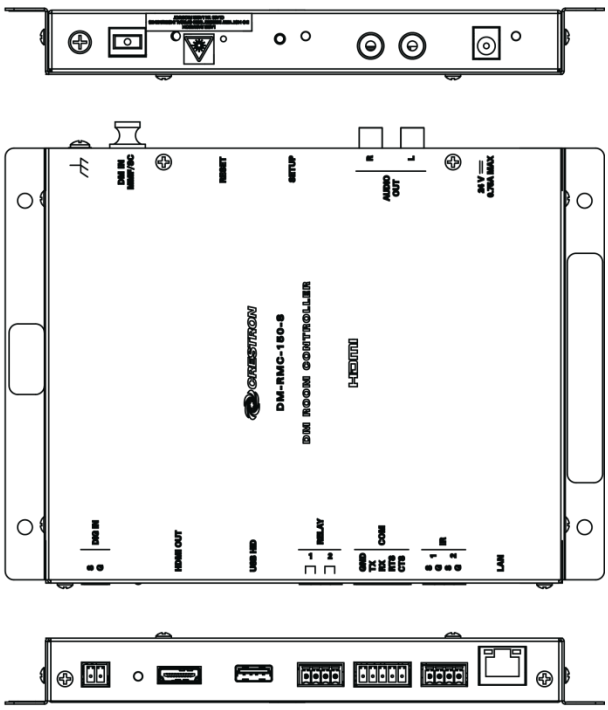
DM-RMC-200-C



DM-RMC-100-S



DM-RMC-150-S



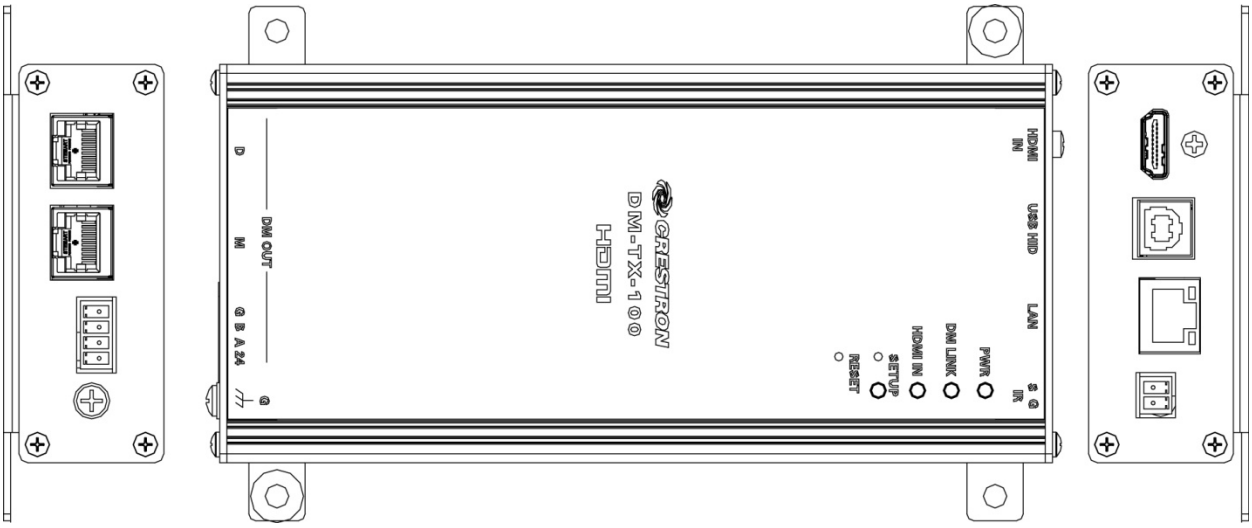
DigitalMedia In-Wall Transmitters and Receivers

DM transmitters provide the ability to add remote sources to the switcher system via DM cables and DM-CAT or Fiber cards. DM transmitters may be used in conjunction with DM switchers, repeaters and receivers.

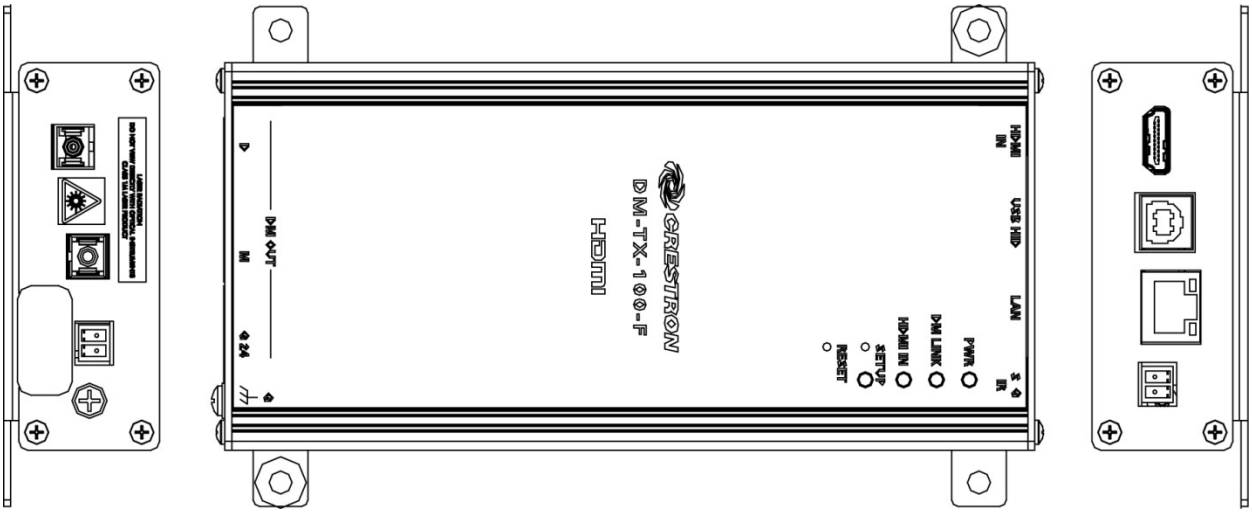
DM-TX-100/-F DigitalMedia HDMI Transmitter

- Connects to DigitalMedia switcher or receiver via DM CAT (DM-TX-100) or multimode fiber (DM-TX-100-F)
- HDMI/DVI input
- USB HID type “B” host port
- IR/1-way RS-232 port
- LAN port
- Rack-rail or surface mountable

DM-TX-100

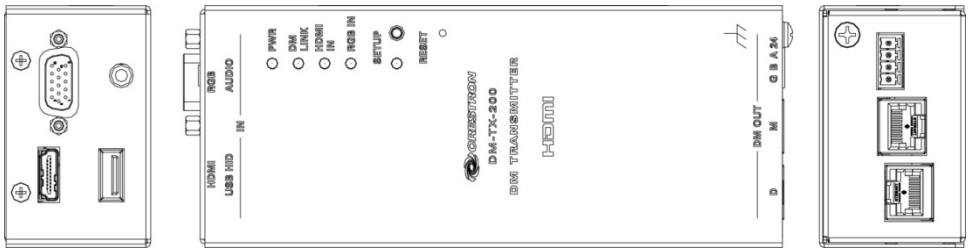


DM-TX-100-F



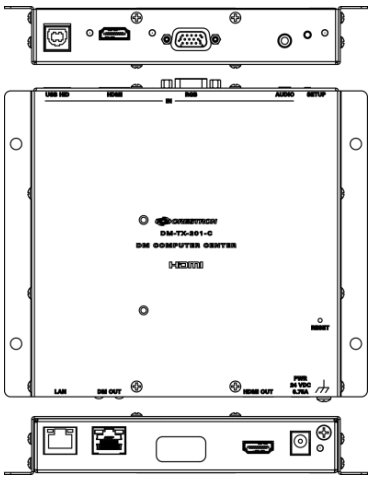
DM-TX-200 DigitalMedia RGB + HDMI/DVI Transmitter

- 2x1 DigitalMedia switcher transmitter for laptop AV and keyboard/mouse commands over DM CAT
- Connects to DigitalMedia switcher or receiver via DM CAT
- RGBHV and HDMI/DVI input
- Analog audio input
- USB type “A” HID device port
- Mount on surface or in Wiremold® 6000 trough horizontally



DM-TX-201-C DigitalMedia 8G STP Transmitter

- 2x1 DigitalMedia switcher transmitter for computer/AV sources and keyboard/mouse commands over DM 8G STP
- Connects to DigitalMedia switcher or receiver via DM 8G STP
- RGBHV and HDMI/DVI/DisplayPort Multimode input
- Analog audio input
- USB type “A” HID device port
- Local HDMI monitor output
- Mounts on a flat surface or placed on a shelf



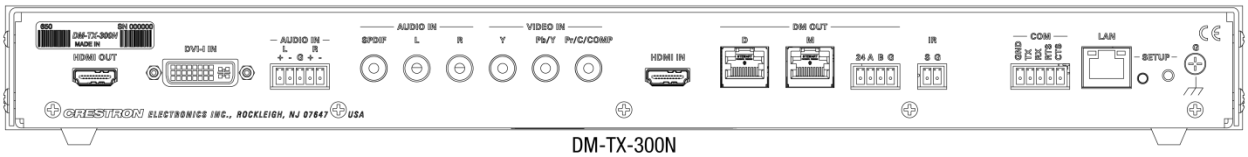
DM-TX-201-S DigitalMedia 8G Fiber Transmitter

- 2x1 DigitalMedia switcher transmitter for computer/AV sources
- and keyboard/mouse commands over CresFiber
- Connects to DigitalMedia switcher or receiver via CresFiber
- RGBHV and HDMI/DVI/DisplayPort Multimode input
- Analog audio input
- USB type “A” HID device port
- Local HDMI monitor output
- Mounts on a flat surface or placed on a shelf

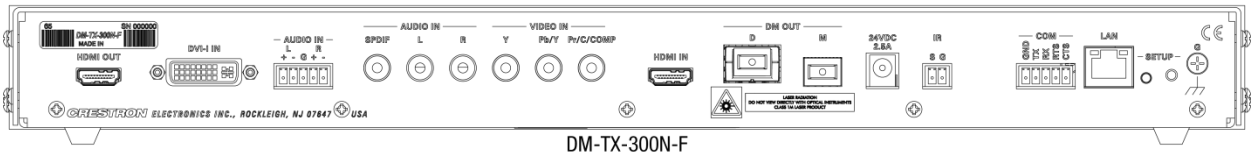
DM-TX-300N/-F DigitalMedia HDMI, DVI-I, + Analog Video Transmitter

The DM-TX-300N allows any common AV signal (video, RGB, DVI, HDMI, DisplayPort Multimode) to be transmitted over a single wire and output locally. It provides an Ethernet port as well as RS-232 and IR control. This combination enables the DM-TX-300N to replace traditionally separate pieces of equipment—the analog video extender, digital video extender, video DA, and mini control processor. It can also be used to extend the input types of an MPS system by adding support for digital video devices.

- Connects to a DM switcher or receiver via DM CAT (DM-TX-300N) or fiber (DM-TX-300N-F)
- DVI-I input
- HDMI input
- HDMI output – Can mirror DVI input or follow DM output
- 1 SPDIF digital audio input
- 2 analog stereo audio inputs – balanced and unbalanced
- Component/S-video/Composite video input
- IR/1-way serial port
- 2-way RS-232 serial port
- LAN port
- Rack mountable (1 RU)
- Can be used as an HDMI converter for analog signals
- Front panel input selection button
- Power supply included with DM-TX-300N-F



DM-TX-300N



DM-TX-300N-F

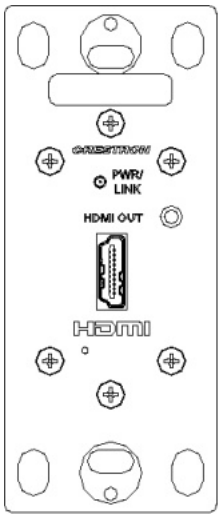
DM-TX1-1G and DM-RX1-1G

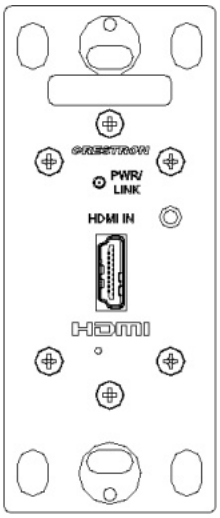
The DM-TX1-1G is a single-gang DM CAT HDMI transmitter. The DM-RX1-1G is a single-gang DM CAT HDMI receiver.

These products can transmit/receive a 1080p/60 8-bit color HDMI signal 125 feet using DM CAT. Repeaters may be used to extend the distance.

These devices connect to other DM products via DM CAT (not fiber) and are powered by DMNet.

- Compact 1-gang wall mount design
- Fits in a FSR FL-500P-6 Floor Box
- Provides HDMI digital video/audio input at any location
- Also supports DVI and DisplayPort Multimode sources

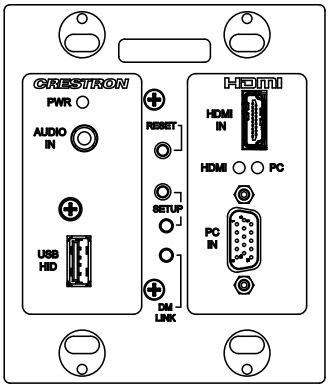




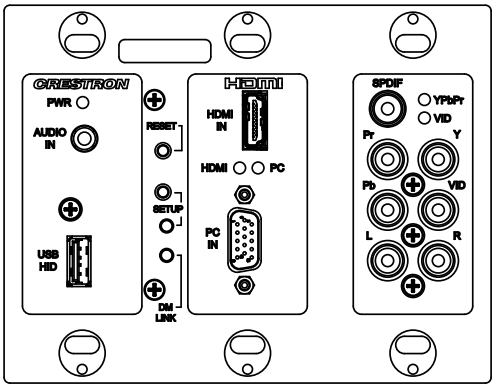
DM-TX-200-2G and DM-TX-400-3G

The DM-TX-200-2G and DM-TX-400-3G provide a remote input connection for HDMI and RGB sources as part of a complete DigitalMedia System and connect to the input of a DM Switcher or RoomBox via DM CAT. Includes a USB HID device port, allowing a mouse/keyboard to be connected for controlling a computer or other host device at a different location. The DM-TX-400-3G also includes a remote input for SPDIF and analog AV sources. The DM-TX-200-2G mounts in a 2-gang electrical box, while the DM-TX-400-3G mounts in a 3-gang electrical box.

- Built-in 2x1 AV switcher (200-2G) or 4x1 AV switcher (400-3G)
- 2-gang (200-2G) or 3-gang (400-3G) wall mount design
- Fits in a FSR FL-500P-6 Floor Box
- Provides HDMI and RGB/component video inputs
- DM-TX-400-3G also provides component and composite inputs
- Supports DVI and DisplayPort Multimode sources
- Includes mini-TRS stereo audio input
- Provides onboard auto-switching capability
- Includes USB HID keyboard/mouse port
- Detects and reports detailed video and audio input information
- Performs automatic AV signal format management via EDID
- Enables device control via CEC
- Easy setup and diagnostics tools via software
- Extends the life of analog-based AV systems



DM-TX-200-2G



DM-TX-400-3G

NOTES:

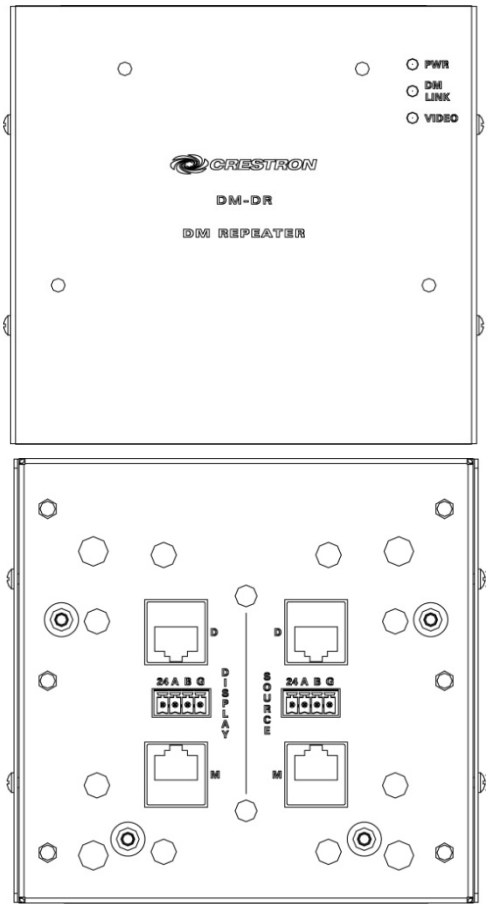
1. For wiring, use DM-CBL DigitalMedia Cable (DM CAT).
2. HDMI requires an appropriate adapter or interface cable to accommodate a DVI or DisplayPort Multimode signal. CBL-HD-DVI and CBL-DP-HD interface cables available separately (see “Appendix D: Crestron Certified Cables” on page 64).
3. The RGB input can accept component, composite, and S-Video signals via direct interface to Crestron MPS Series products, or through an appropriate adapter (not included). Input sync detection is not provided for composite or S-Video signal types through the RGB connection.

DigitalMedia Repeater DM-DR

Reproduces signal for error-free delivery with DigitalMedia Cable. Up to two repeaters can be installed in a given signal path.

- Allows DM Cable lengths to be extended in up to 200 ft. increments
- Up to 2 repeaters may be installed in a single DM cable run to enable cable lengths up to 450 feet
- Mounts to a standard 2-gang, 4” square, or UK electrical box

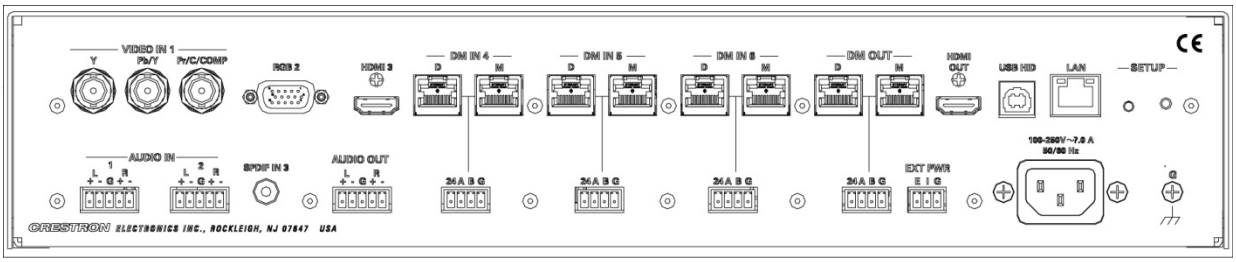
NOTE: DM-DR is not compatible with DM 8G products.



Installing the Repeaters

Repeaters mount to a deep 2-gang or 4-inch square wall box. DM CAT connections are on the back side and tuck away neatly inside the gang box.

DM-MD6X1 Switcher



- The DM-MD6X1 can be used as a stand-alone device with transmitters and a room controller
- The analog inputs can be expanded with an MPS or RGBHV switcher
- The digital inputs can be expanded with an HD-MD8X1 or HD-MD8X2 switcher
- Performs analog/HDMI audio conversion
- Provides DM devices with 30W of power
- Two rack unit size

Video

The DM-MD6X1 supports all common video formats, both analog and digital, and converts them to a single video type to simplify system design and wiring. The HDMI and DigitalMedia CAT outputs are in parallel so they can be used simultaneously to send video over structured wiring to the display and output to a local device.

Video Inputs

- Video 1: Composite (NTSC/PAL), S-video (NTSC/PAL), Component (up to 1080p60)
- Video 2: RGB up to 1920x1200, Component, S-video and Composite
- HDMI connector, supporting HDCP on any of the signal types below:
  - > HDMI signals up to 1080p60
  - > DVI signals up to 1920x1200
  - > DisplayPort multimode up to 1920x1200
  - > DigitalMedia, from any Crestron DigitalMedia (CAT) transmitter

Video Outputs

- DM CAT
- HDMI

Audio

The DM-MD6X1 cross-converts all audio formats as well, so analog audio signals can be sent to a display as HDMI audio; HDMI audio signals from laptops can be output to a traditional analog amplifier.

Audio Inputs

- HDMI and DM – 8-channel high-definition audio
- SPDIF
- Stereo analog audio

Audio Outputs:

- Stereo analog audio with volume control
- 8-channel audio via the DM and HDMI outputs

USB

The DM-MD6X1 can process USB-HID keyboard and mouse signals from other DM devices in the system and relay them to a connected PC or Mac. Separate USB signal extenders are not required.

Step 3: Prewiring

HDCP Wiring Notes

When HDCP is not used, there are no midpoint limitations inherent to DigitalMedia (as with QuickMedia®).

When HDCP is used, too many hops in a single signal path (source to sink) can create potential HDCP problems.

The maximum number of hops is six (i.e., source to wallplate to switcher to receiver to display is three; DM repeaters and DM receivers are not added to the count).

Contact Crestron Sales Support Services for design support (1-888-CRESTRON).

DigitalMedia CAT

When pre-wiring an installation using DM CAT, ensure that you have provided an area for repeater insertion wherever one is required, as based on your distance calculations. Crestron recommends that you put the wire in a 2-gang box or trim ring and leave a 1-foot loop available to splice in a repeater as necessary. There are foot markings on the DM CAT for determining length of run.

DigitalMedia 8G STP

Repeaters are not compatible with DM 8G STP, so ensure that the 330 foot maximum cable length is sufficient. When wiring, install DM 8G STP in the same manner as regular CAT6 cable. Consider wiring fiber for cable runs approaching 330 feet.

DigitalMedia Fiber and DigitalMedia 8G Fiber

When installing fiber optic cables, ensure that you have an adequate bend radius available in any conduit you are using. Most fiber optic cables can support a bend radius of three inches under load. It is also recommended that you install spare fiber optic strands in the event the fiber breaks. Crestron CresFiber contains 4 strands of fiber. For DM Fiber products, there will be two spare fiber strands. For DM 8G Fiber products, there will be three spare fiber strands.

Designers should also remember that Crestron recommends that fiber equipment should be powered locally via the included power supply.

DigitalMedia Device Quantity Limits

There are some HDCP limits as shown, below. Otherwise, there are no DigitalMedia maximum limits. The size of the system can be increased as far as you like, subject to normal limitations with regard to memory, program size, etc.

- No more than 128 devices total (each DigitalMedia switch counts as one device)
- You cannot go more than six levels – i.e., hops - deep (each DigitalMedia switch counts as one level; see page 52 for details)
- For design assistance, contact Crestron Sales Support Services

Power and Heat Calculations

The DM-MD8X8, DM-MD16X16, and DM-MD32X32 provide 24VDC power for equipment connected via DM CAT, such as transmitters, room controllers, and repeaters. RPS models do not supply any power via DMNet. Specifications are as follows:

	Max Power Consumption	Heat Dissipated (BTU/Hr)	Power available via DMNet
DM-MD8X8	211 Watts	475	55 Watts
DM-MD16X16	376 Watts	792	110 Watts
DM-MD32X32	1100 Watts	3000	220 Watts

Room Controller, Repeater, and Transmitter Power Consumption:

- DM-RMC-100-1 – 6 Watts
- DM-RX1-1G – 5 Watts
- DM-DR – 3 Watts
- DM-TX-100 – 9 Watts
- DM-TX-200 – 12 Watts
- DM-TX1-1G – 4 Watts
- DM-TX-200-2G – 10 Watts
- DM-TX-400-3G – 12 Watts

NOTE: The DM-TX-300N/-F and all DM 8G STP devices (models with a "-C" suffix) ship with a power supply.

If more power is needed for DigitalMedia devices, it can be provided externally using the "EIG" jumpers to bring in power from a standard 24V Crestron power supply. Refer to the manual for hookup information.

Powering DigitalMedia 8G

DM 8G room controllers and transmitters include external "wall wart" power supplies. For DM 8G Fiber, the included power supply is the only option for power. However, for DM 8G STP products, power can be provided through the DM 8G STP cable. When using this method, the external power supply is no longer necessary. Room controllers and transmitters can be placed where power outlets are not available.

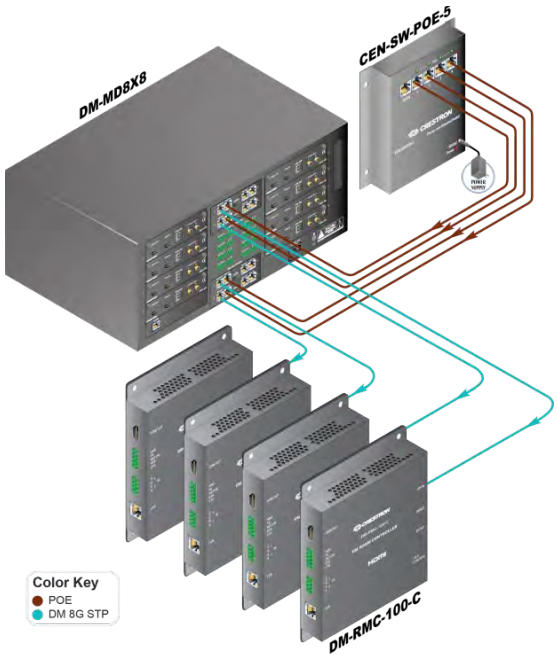
On the DM 8G STP (DMCO type 5) output cards, there are ports labeled "POE IN." Simply connect a CAT5/6 type cable from a PoE power supply or switch into the "POE IN" port on the output card. The DM switcher will automatically send this power over DM 8G STP to the room controllers and transmitters.

Crestron makes several products capable over supplying PoE. These products include:

- PWE-4803RU: Single port PoE injector; can power one DM 8G product
- CEN-SW-POE-5: Rack or wall mountable switch; includes four ports (plus one uplink) and can power up to four DM 8G products
- CEN-SW-POE-24: Rack mountable switch; includes 24 ports for powering up to 24 DM 8G products

DM 8G PoE Example

The CEN-SW-POE-5 provides four PoE ports that are connected via CAT5/6 to the "POE IN" ports on each output card. DM 8G STP connects the output cards to the room controllers and provides power for the modules.



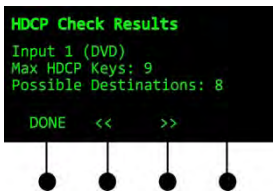
Step 4: System Commissioning

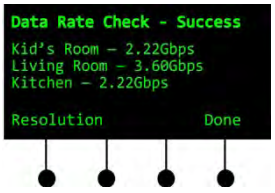
The commissioning process tunes the system for optimal performance. Commissioning may be done from the front panel of the DM switcher or using the Wizard in Crestron Tool Box.

The DigitalMedia system works out of the box to route any of the sources to any display to test the signal flow.

Once all of the equipment is installed, the system requires commissioning, which tests the integrity and capabilities of cable, sources and destinations.

The switcher tests all HDMI sources and displays for switching limitations imposed by the number and support of HDCP Keys.



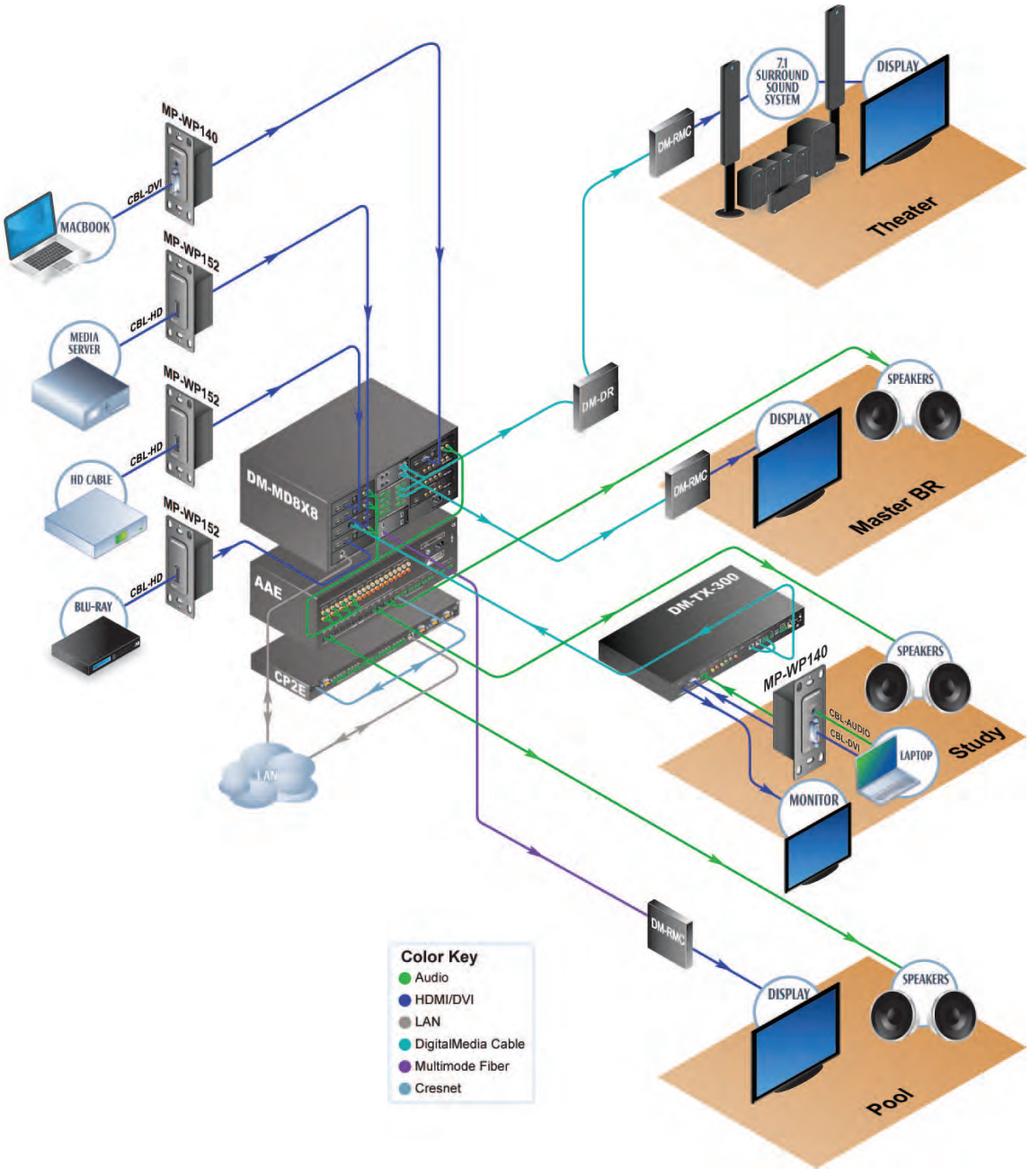


Appendix A - Application Diagrams

Residential Multi-Room Distribution

Multi-room distribution in residential environments involves the combining of several sources and format types to different makes and resolutions of displays. Crestron DigitalMedia enables the distribution, resolution determination and HDCP management across a minimal whole home infrastructure. DM allows a homeowner to play the content where they want it, when they want without compromising resolution.

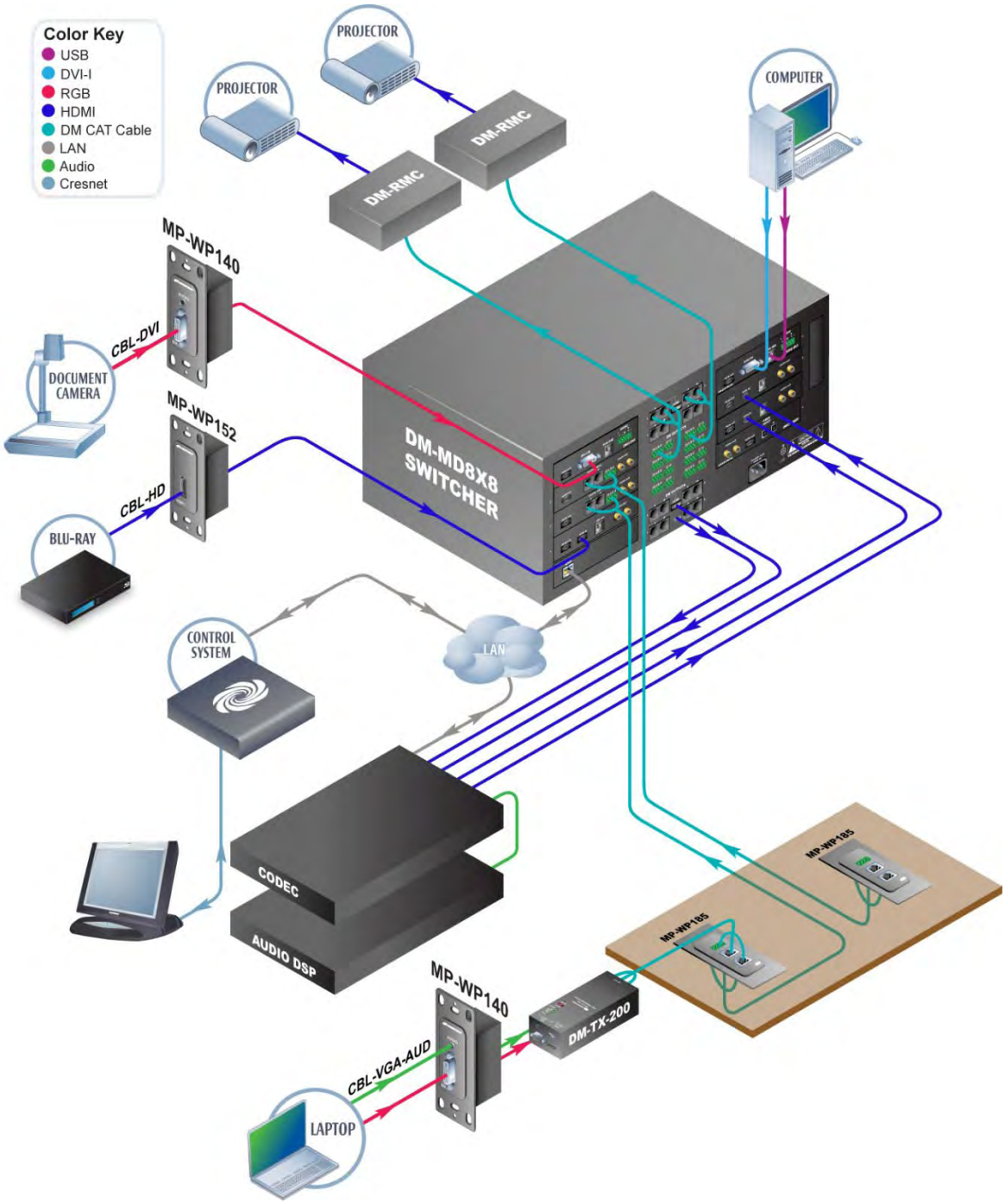
- Multi-source, multi-room HDMI distribution
- Remote located sources using DM transmitters
- Up to 8 sources and 8 displays



Commercial Video Conference Room

Video conference rooms require combining disparate media to be transmitted to a remote location and on multiple local displays simultaneously. All teleconference codecs now provide an HD signal via HDMI with HDCP protection. The Crestron DigitalMedia distribution system brings all your sources together—analog and digital—managing resolutions and EDID to provide the highest quality signal with our exclusive low-latency QuickSwitch HD™ switching technology.

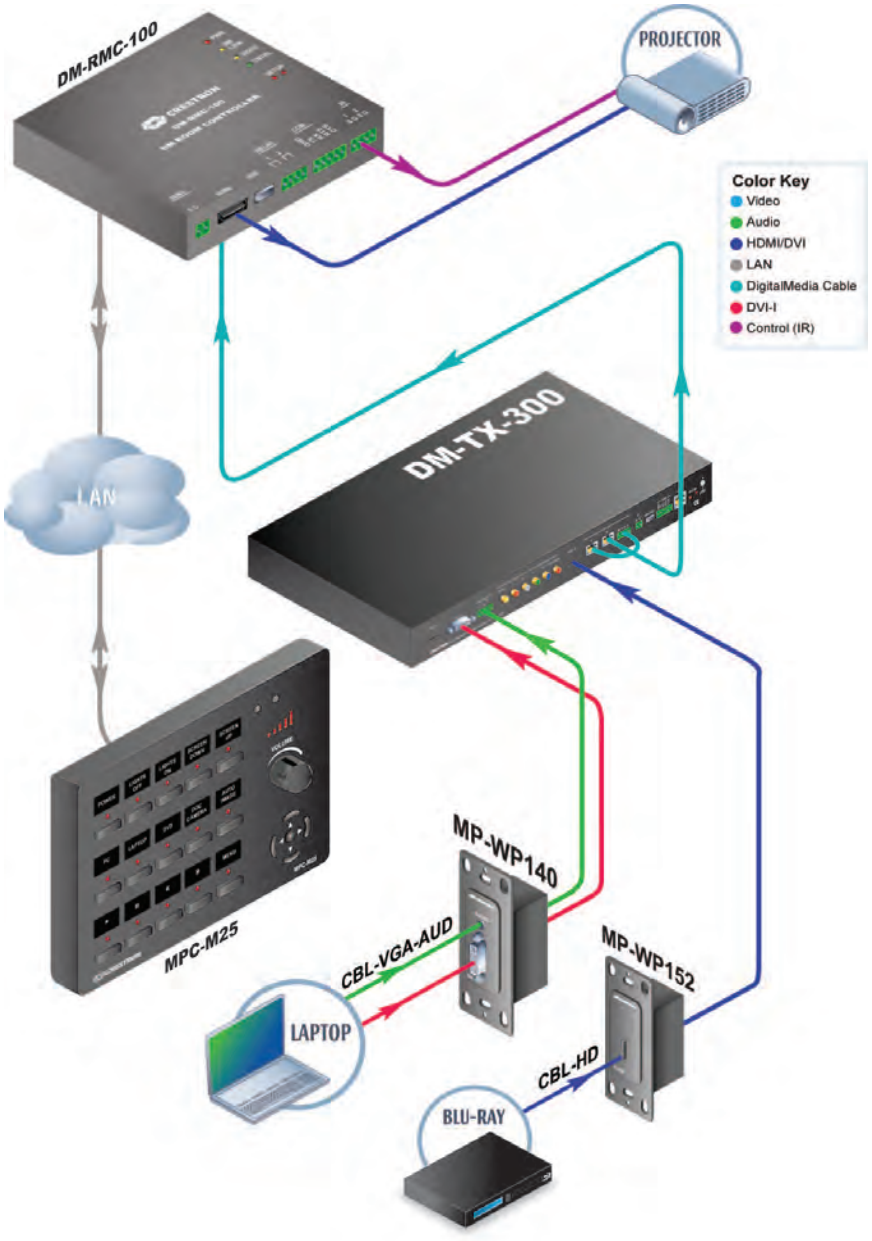
- Multi-source, multi-display/endpoint HDMI distribution
- Remote sources using hot-swappable DM transmitters into interface plates
- Up to 8 sources and 8 displays



Commercial Small Room with Single Display

An average simple presentation room is equipped with a single display and several analog and digital sources for the presenter, including a laptop port. In addition, the instructor has a local display to view their computer output. These smaller rooms usually have very tight space requirements for equipment in the lectern. This simple DigitalMedia solution provides a great amount of AV input flexibility without compromising on digital video or complicating the room wiring.

- Single DM transmitter with multi-source switching
- Single DM receiver provides HDMI content and display control
- System controlled by simple wall mounted interface/processor

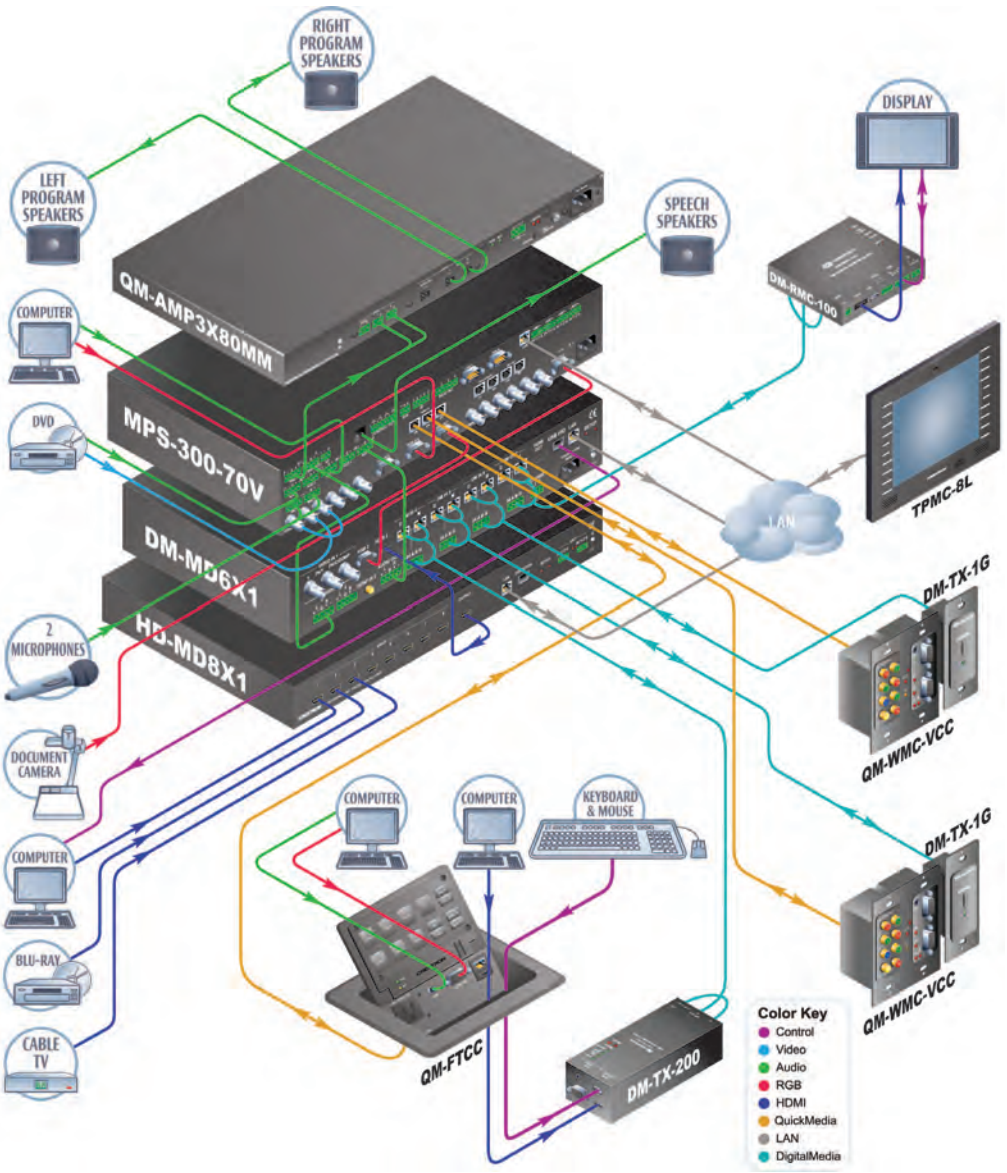


NOTE: External power supply not shown

Commercial Conference Room with MPS, QM and DM Components

With a number of input card options and room controller boxes, Crestron DigitalMedia can be easily incorporated into existing Crestron QuickMedia distribution systems. Integrating DigitalMedia distribution into your existing topology provides access to High Definition content without having to rebuild an entire installed system.

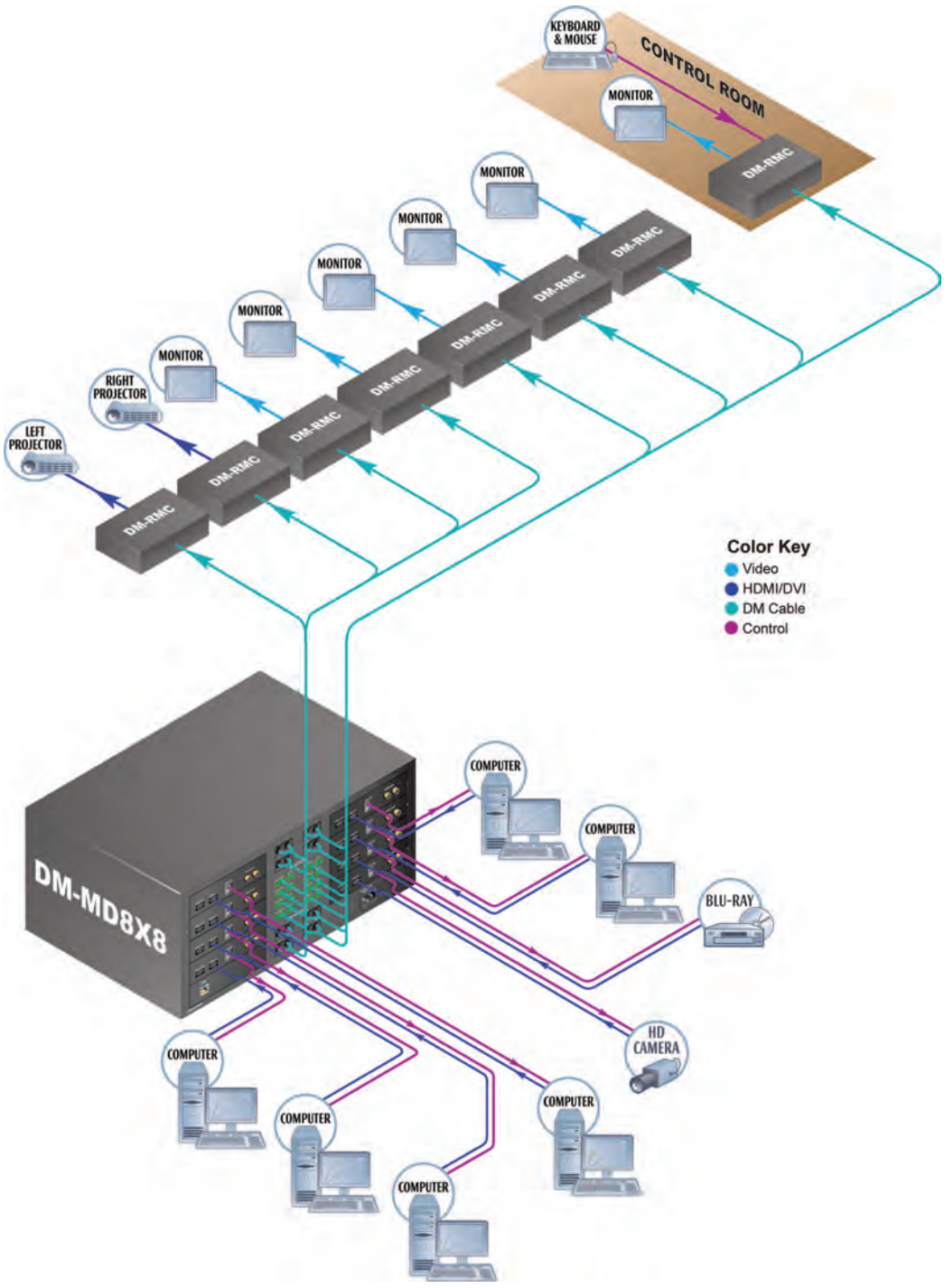
- MPS-300 provides AV switching and control
- DM-MD6X1 hybrid switcher provides MPS-300 with digital DM connectivity
- QM wall plate transmitters for analog AV sources
- Fliptop QM interface/keypad with DM transmitter provides VGA and HDMI connectivity
- HDMI switcher for additional HDMI sources in the system
- All sources sent to display over a single format and single DM cable



Digital Signage System

Digital Out-Of-Home advertising and information systems require dynamic high resolution graphics, glitch-free switching and a straightforward topology. Crestron DigitalMedia provides the best method of content delivery in High Definition.

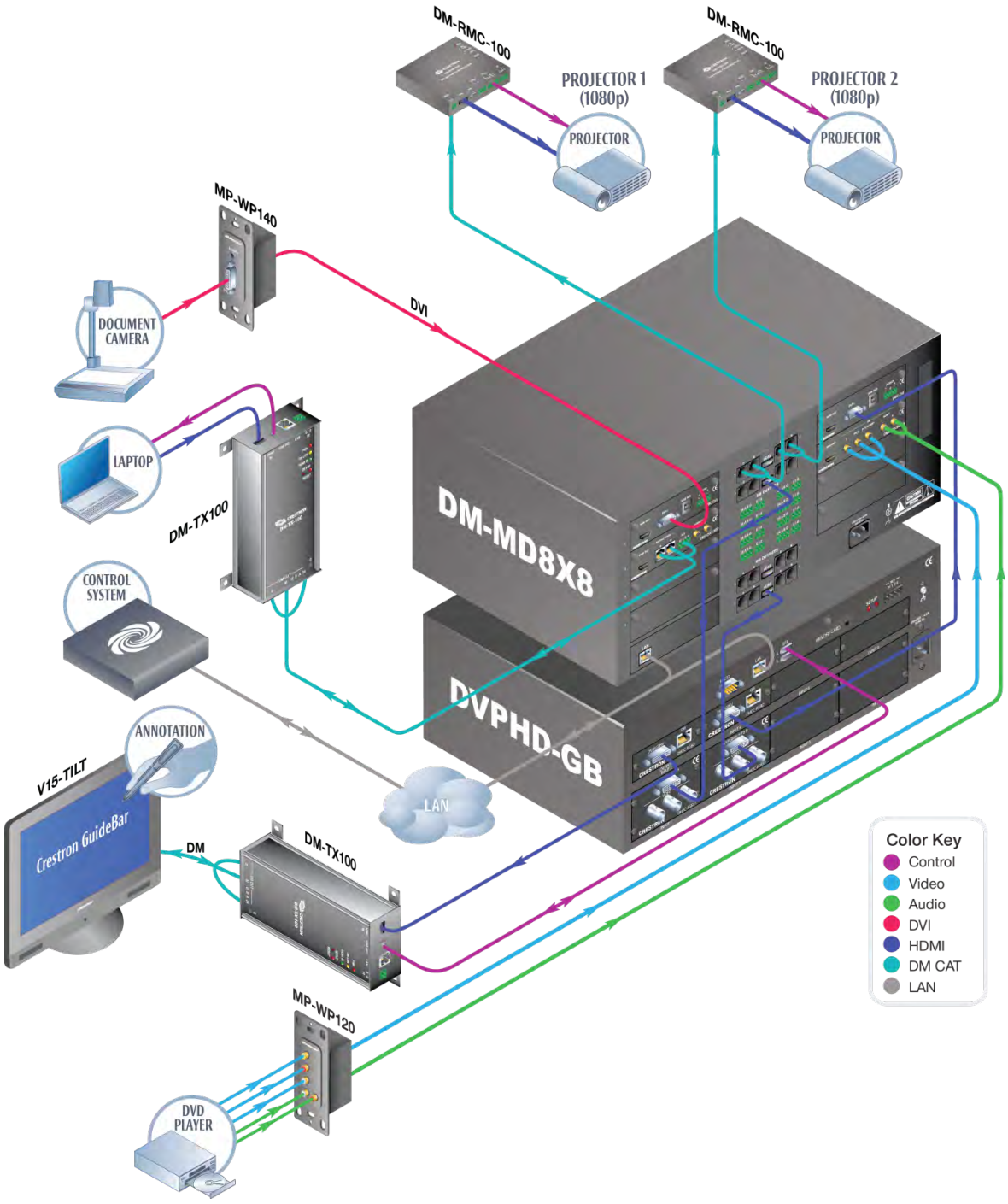
- Multi-source, multi-display HDMI distribution
- Long distance capability using CresFiber
- Source computer control via HID USB connection on any DM-RMC



Multi-Window Processing and Annotation with DM Switching

Displaying and annotating multisource/multi-display HD content transmitted over HDMI can be complicated or nearly impossible, as most systems cannot maintain HDCP across multiple points. Crestron DM, combined with the DVPHD-GB video processor, provides HD multi-window processing, annotation and switching.

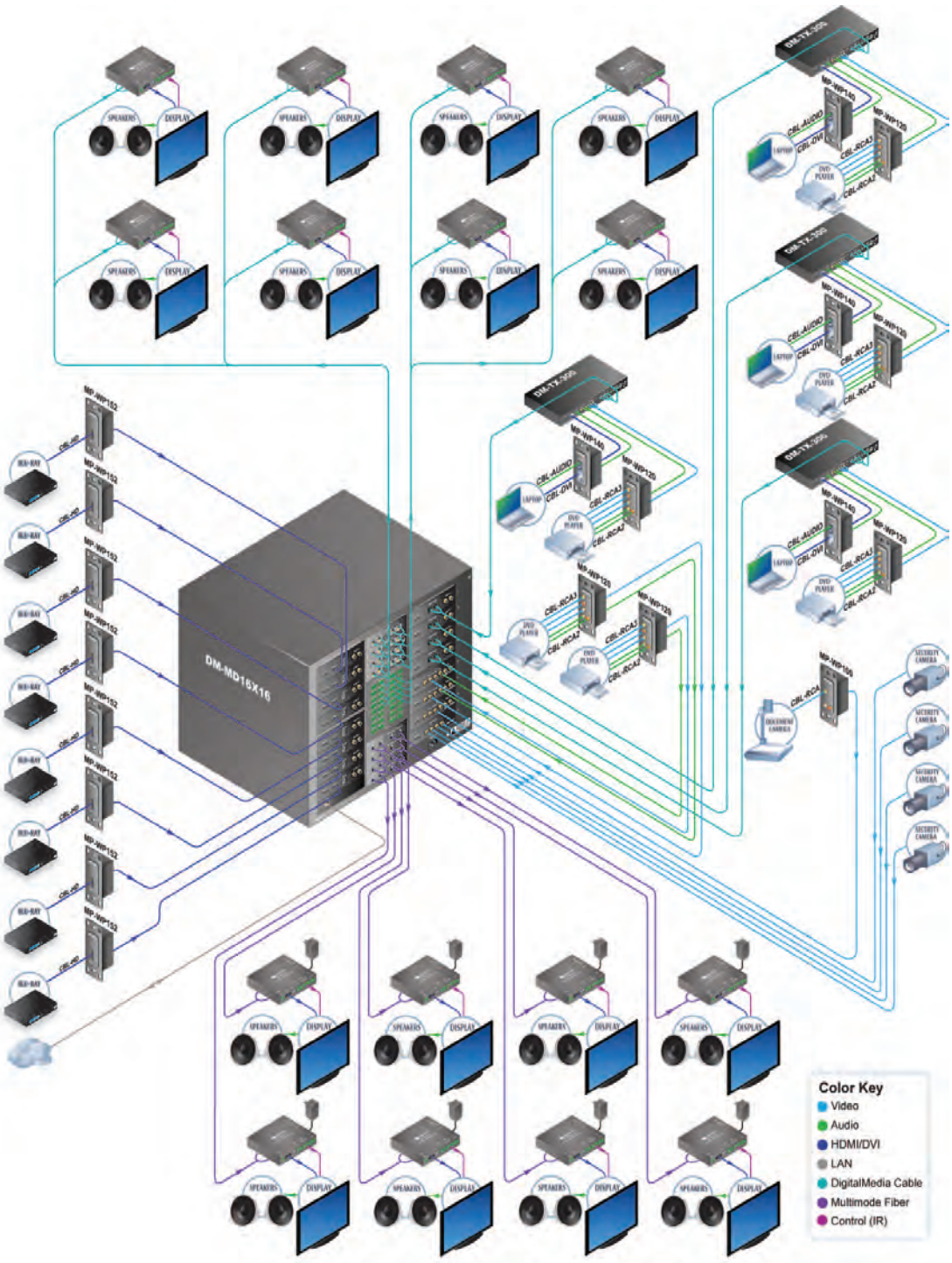
- Multi-source, multi-display HDMI distribution
- Multi-Window processing and annotation over any source(s)
- Maintains HDMI with HDCP from source unit to display



Large-Scale System

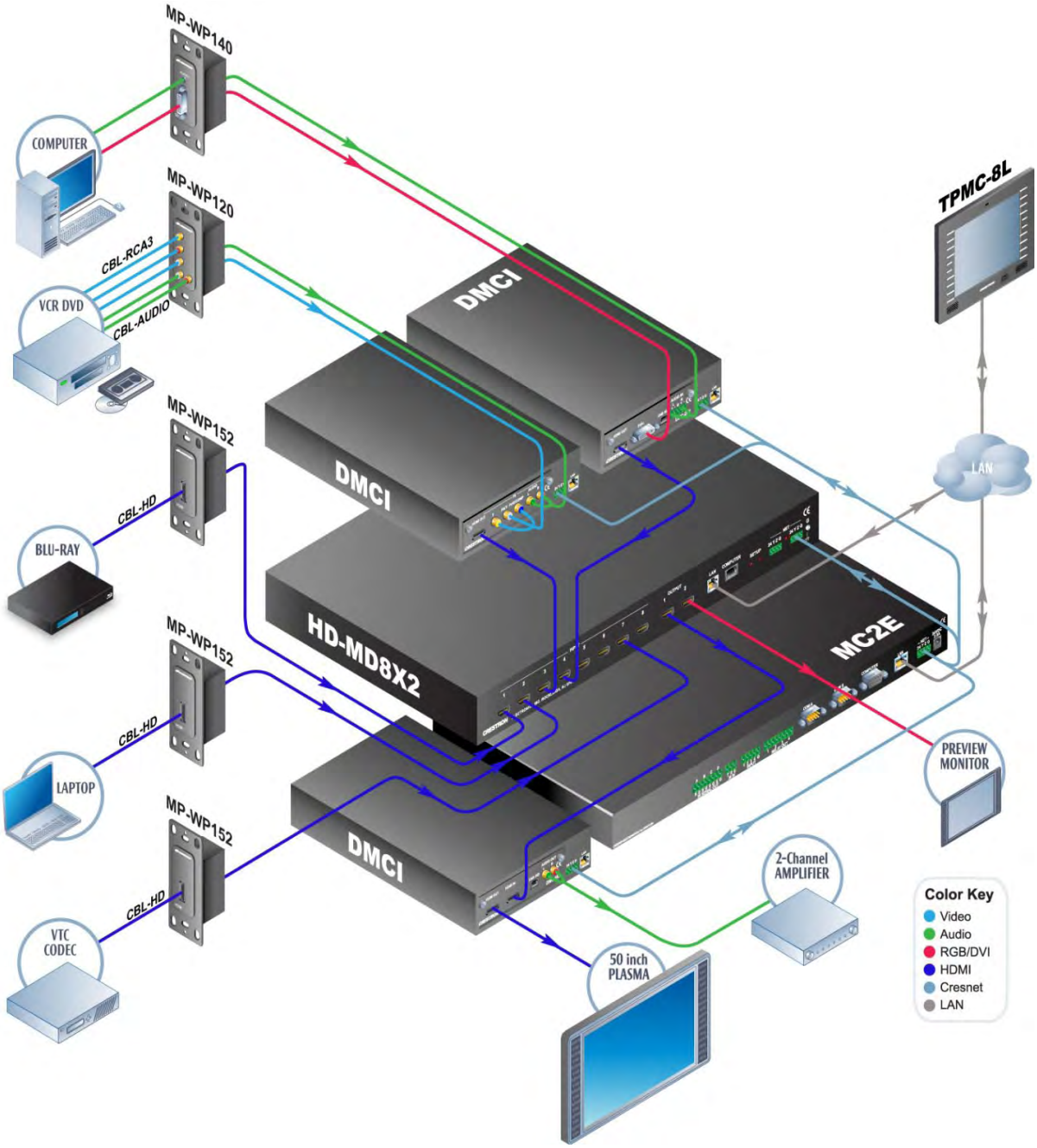
Large scale distribution systems require switcher systems with the flexibility and power to manage multiple source and destination resolutions and HDCP keys.

- 16 input card slots (field upgradable)
- Two output module slots with up to eight outputs on each module (factory upgradable only)
- Full audio and USB breakaway
- 7-space 19-inch rack-mountable



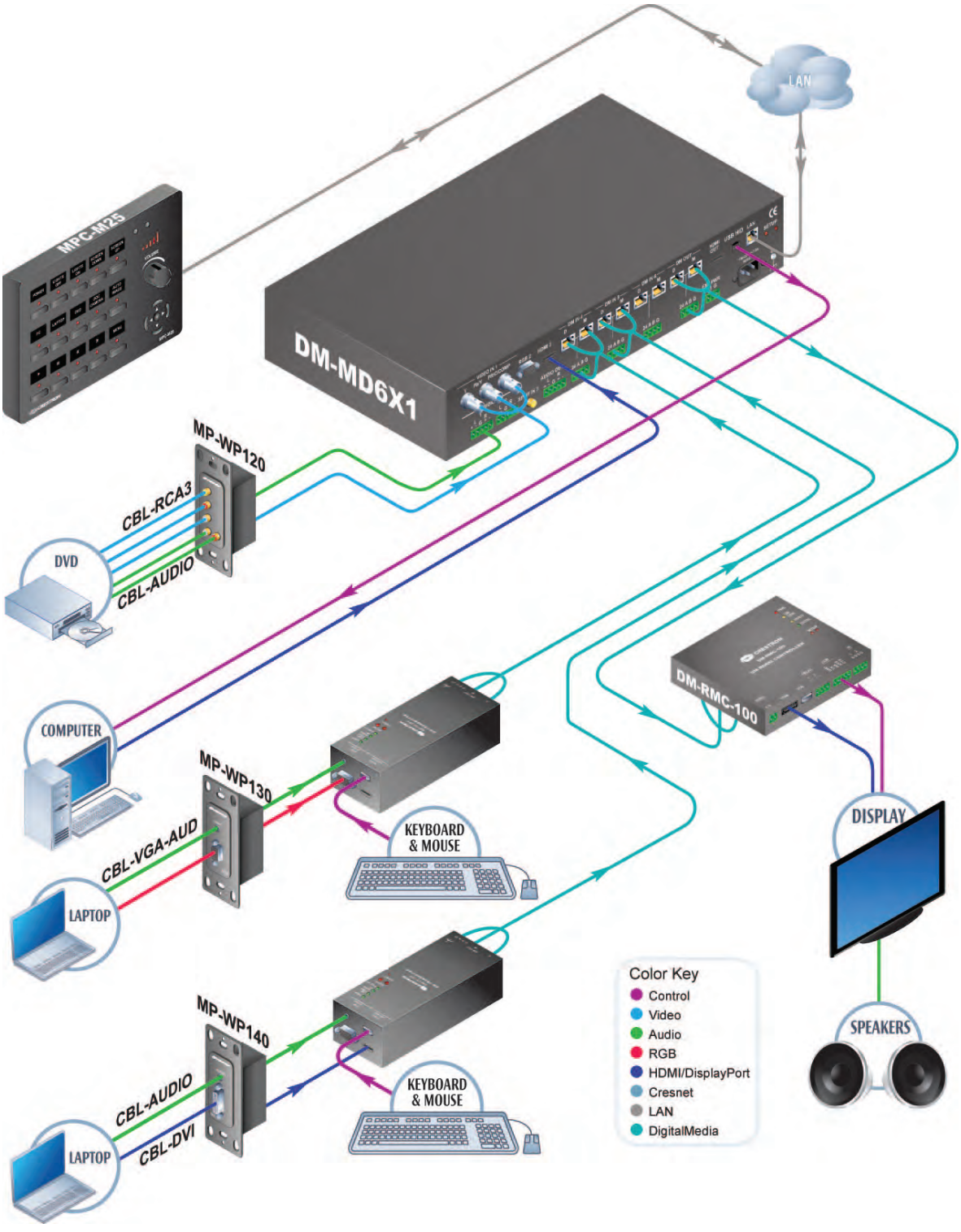
Low Cost HD Video Conferencing System

- DMCI/DM input card set provides analog video to HDMI conversion
- DMCI/DM input card set extracts audio from HDMI signal and provides volume control
- DMCI/DM input card set provides DVI with balanced audio input for an HDMI switcher
- System maintains HDMI fast switching with full HDCP compliance



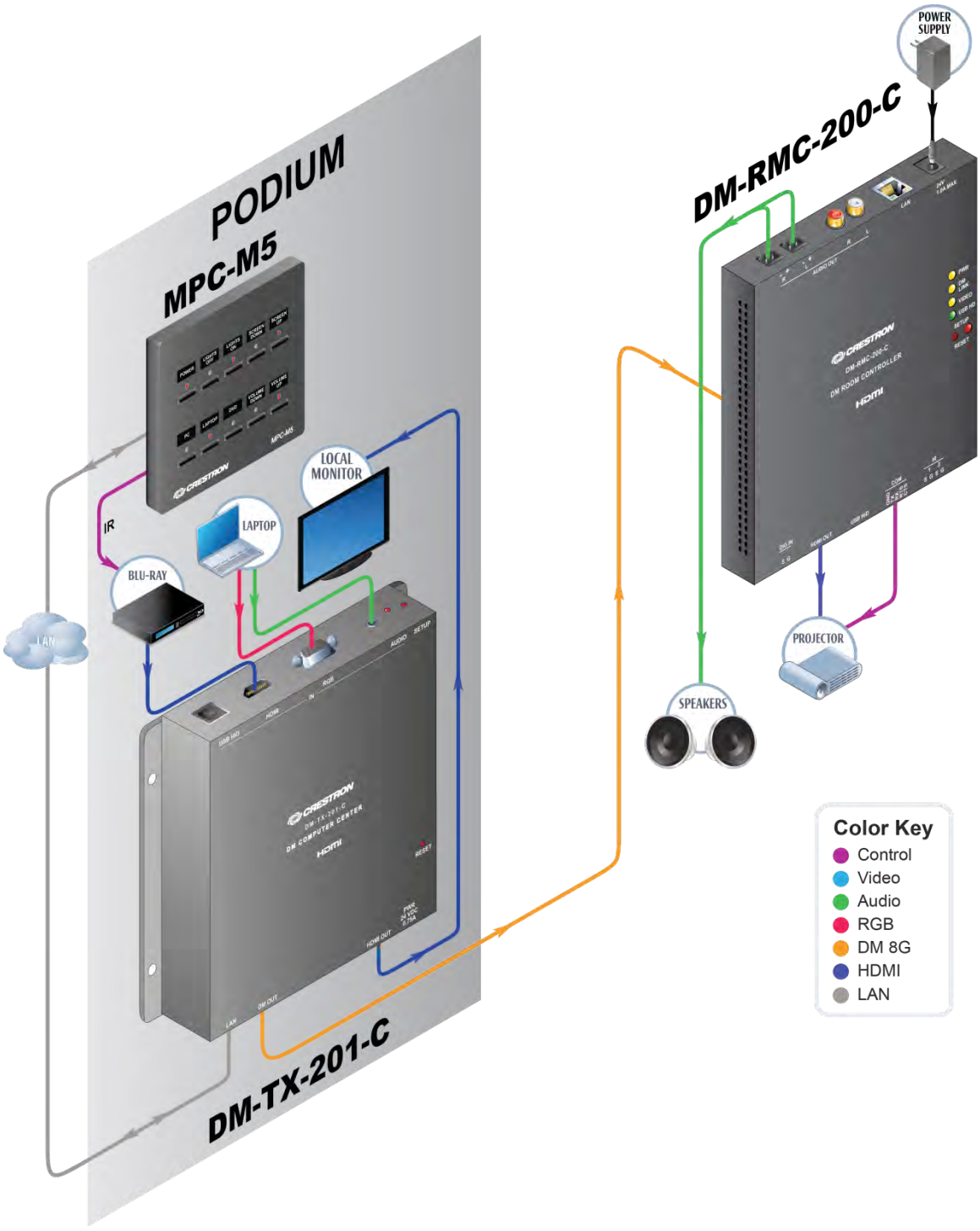
Low Cost Complete DigitalMedia Solution

- All sources, both analog and digital, switched to a single digital output
- Remote-located sources and USB HID devices using DM transmitters
- Up to 3 DM sources, 2 analog sources and 1 HDMI source
- Simple control using wall mounted keypad/processor



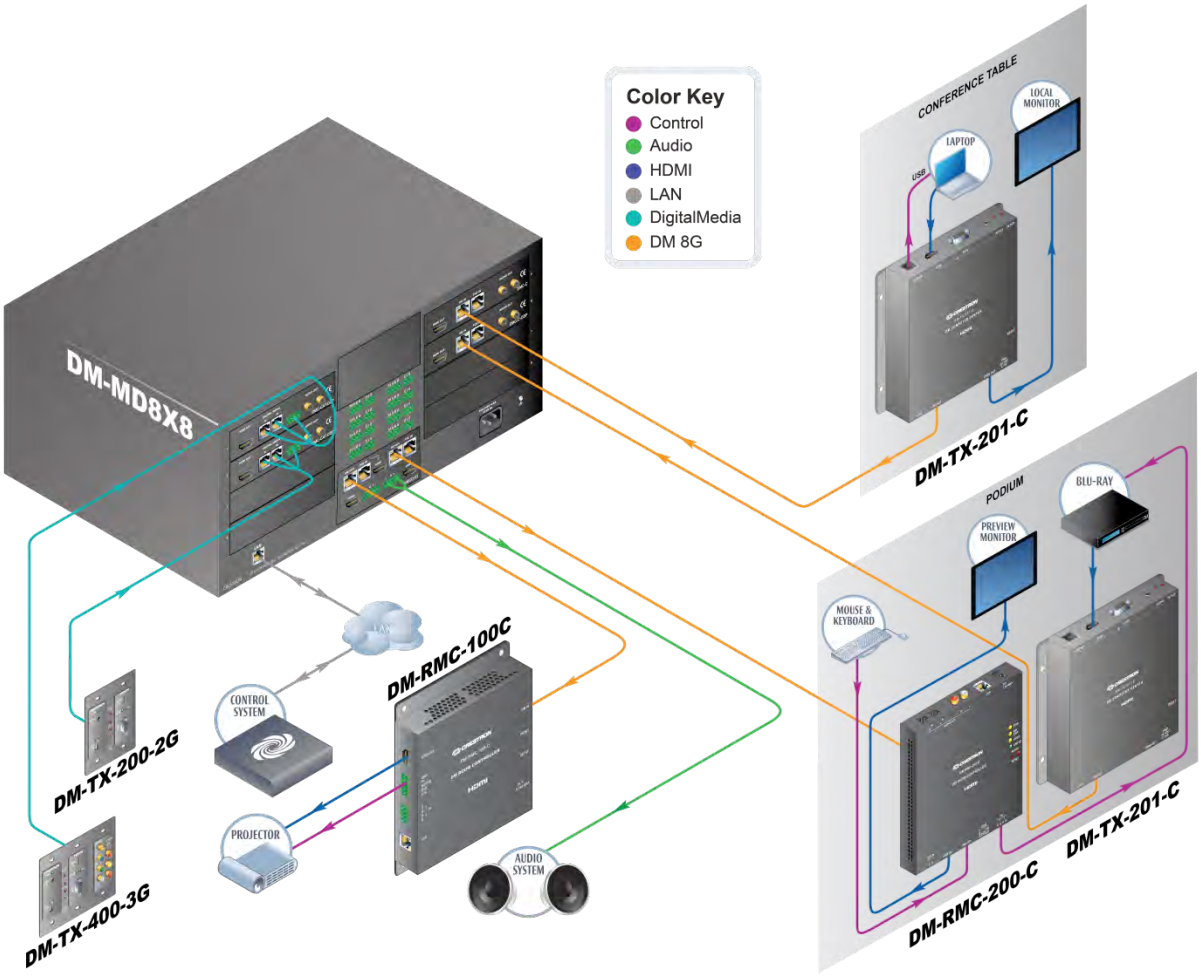
Low Cost Classroom Using DM 8G

- Laptop and Blu-Ray sources located at podium, local monitor can display either source
- Single DM 8G STP cable runs from the podium to the room controller located by the ceiling projector
- Projector connects via HDMI, a built-in 30 Watt amplifier powers speakers in the room
- Simple control using a control system connected via Ethernet
- Room controller sends power from the power supply to the podium via DM 8G STP



Powerful Boardroom Using DM 8G and DM CAT

- DM-MD8X8 connects to control system via Ethernet, wall plates via DigitalMedia CAT
- Two room controllers and two computer centers connect to the DM-MD8X8 via DigitalMedia 8G STP
- First room controller (DM-RMC-100C) sends video to the projector via HDMI
- Second room controller (DM-RMC-200-C) sends video to a monitor via HDMI, connects the USB keyboard and mouse, and controls the Blu-Ray player via IR
- Computer center (DM-TX-201-C) at the podium sends Blu-Ray audio and video to the DM-MD8X8
- Computer center (DM-TX-201-C) at the conference table sends USB signals from the keyboard and mouse to the laptop, sends audio and video from the laptop to the DM-MD8X8, and mirrors the laptop display on a local monitor



Appendix B - HDCP

HDCP Limits in Source Devices

All HDMI sources that utilize HDCP limit the number of devices that may be connected at any given time. An important aspect of HDCP is its use of “keys” to manage the handshaking that occurs between any two devices.

Every HDMI source device has a limit to the number of downstream devices it can support, determined by the number of available HDCP keys, while simultaneously limiting the depth of devices in the signal path.

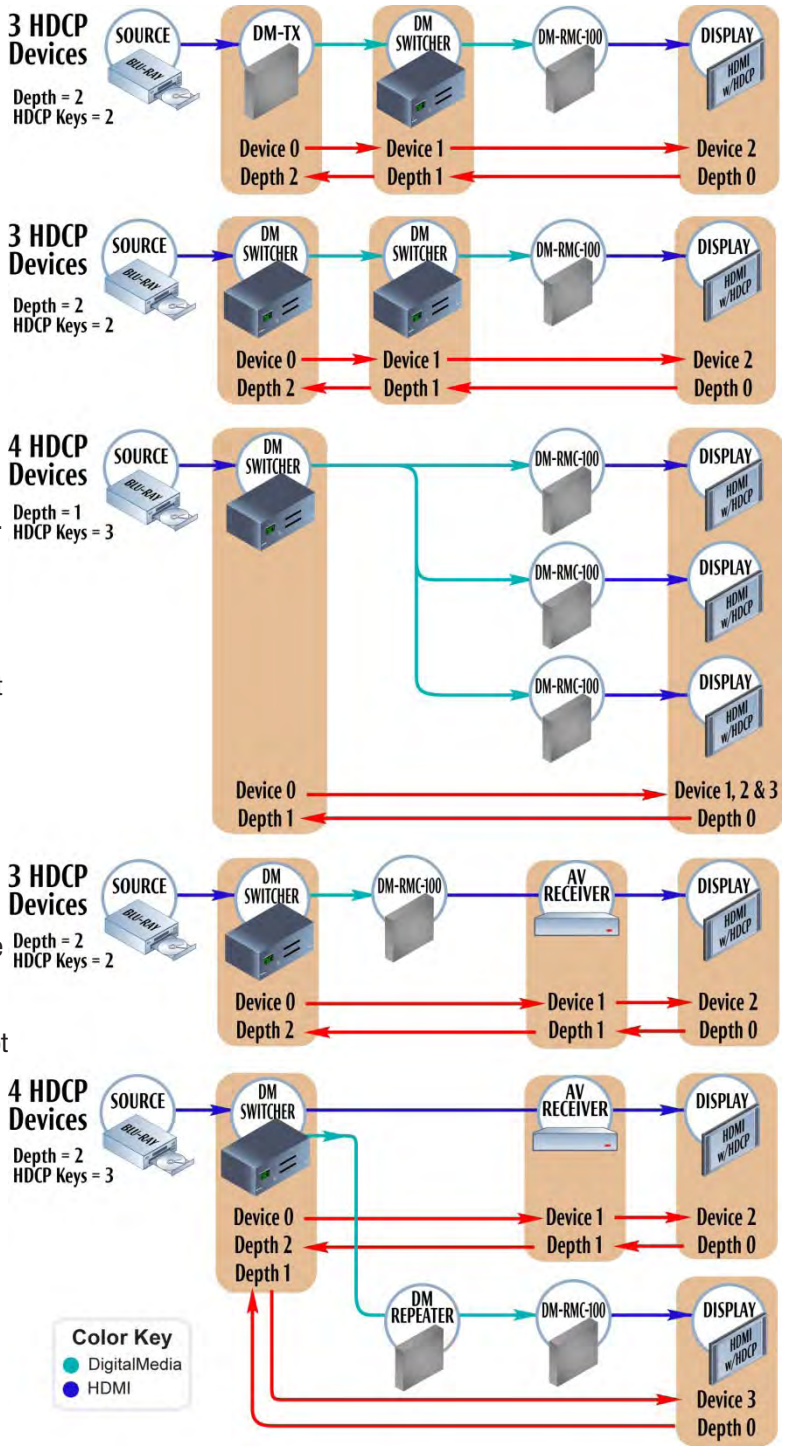
Too many devices or greater-than-allowed depth in a signal path (from source to display) may create problems with displaying of audio and video content.

The HDCP specification states that the maximum depth of devices between source and display is six. Connecting too many displays or processors causes the source to simply stop outputting a signal without warning.

To prevent failures, DigitalMedia tests the HDCP limits of each HDMI source, allowing the installer to configure the system around any limitations, or substitute a different component.

This diagram presents a few possibilities to illustrate the HDCP key and device depth limitations.

NOTE: Room Media Controllers and Repeaters do not require HDCP Keys and do not count as devices.



Device List as of 12/13/2010

The following is a list of the devices Crestron has tested, and the maximum number of devices each supports.

High Definition Disc Players

Source Type	Manufacturer	Model	HDCP Keys
Blu-Ray	Denon	BDP-1610	16
Blu-Ray	LG	BD-270	10
Blu-Ray	LG	Super Multi-Blue	16
Blu-Ray / HD-DVD	LG	LG-BD370	10
Blu-Ray / HD-DVD	LG	LG-BD390	16
Blu-Ray	Integra	DBS 6.9	3
Blu-Ray	Integra	DBS 30.1	3
Blu-Ray	Insignia	NS-2BRDVD	13
Blu-Ray	Marantz	DV4001	9
Blu-Ray	Marantz	BD-7004	3
Blu-Ray	Marantz	BD-7003	3
Blu-Ray	Panasonic	DMP-BD80	3
Blu-Ray	Panasonic	DMP-BD60	3
Blu-Ray	Panasonic	DMP-BD35	3
Blu-Ray	Panasonic	DMP-BD30	3
DVD (upscale 1080P)	Philips	DVP5990/12	9
Blu-Ray	Philips	BDP 7200	16
Blu-Ray	Pioneer	BD-LX80	16
Blu-Ray	Pioneer	BD-LX91	16
Blu-Ray	Pioneer Elite	BDP-05FD	16
Blu-Ray	Pioneer	BDP-6000	16
Blu-Ray	Samsung	BD-P-3600	16
Blu-Ray	Samsung	BD-P-1600	7
Blu-Ray	Samsung	BD-P1500	7
Blu-Ray	Samsung	BD-P1000	16
Blu-Ray	Samsung	DBD-P1500	16
Blu-Ray	Samsung	BD-UP5000	10
Blu-Ray	Samsung	BD-T3600	16
Blu-Ray	Sharp	BD-HP21U	3
Blu-Ray	Sharp	BD-HP22	3
Blu-Ray	Sharp	BD-HP50	3
Blu-Ray	Sharp	BD-HP20	16
Blu-Ray	Sony	DVD-P DPX - 2380	9
Blu-Ray	Sony	BDZ-X100	8
Blu-Ray	Sony	BDP-S5000ES	16
Blu-Ray	Sony	BDP-S350	8
Blu-Ray	Sony	BDP-S360	8

High Definition Disc Players

Source Type	Manufacturer	Model	HDCP Keys
Blu-Ray	Sony	BDP-S550	10
Blu-Ray	Sony	BDP-S2000ES	16
Blu-Ray	Sony	BDPS301	16
Upscaling DVD	Sony	DVP-NS71HP	16
Upscaling DVD	Sony	DVP-NS72HP	9
HD-DVD	Toshiba	HD-A3	16
HD-DVD	Toshiba	HD-A30	16
HD-DVD	Toshiba	HD-D3	16
HD-DVD	Toshiba	HD-E1	10
HD-DVD	Toshiba	HD-A20	10
HD-DVD	Toshiba	HD-A35	16

Cable, TiVo® & Satellite Set Top Boxes*

Source Type	Manufacturer	Model	HDCP Keys
IPTV Set Top Box	Advanced Digital Broad-cast	ADB-3800W	16
Satellite receiver	DirecTV	HR21	NA
Dish Network Receiver	Dish Network	ViP-211	16
Satellite receiver	EchoStar Europe	Vi P211	16
Satellite receiver	Echostar STB	VIP-222	16
Hospitality Tuner	Enseo	HD2000	16
HD Set Top Box	Motorola	VIP 1200	16
Cable Box	Motorola	DCT-3200	1
Cable Box	Motorola	DCT-3412	1
Cable Box	Motorola	DCT-6412	1
Cable Box	Motorola	DCT-6416	1
Cable Box	Motorola	DCH-3416	1
Cable Box	Scientific Atlanta	Explorer 8300HD	16
Cable Box	Scientific Atlanta	Explorer 4250HD	16
Satellite receiver	Sky	Sky HD	16
HD Set Top Box	TiVoHD	TiVoHD	16

*These sources were tested with firmware from the indicated cable company. Other cable companies' products may have different limits.

Media Servers, Game Systems & Other Devices

Source Type	Manufacturer	Model	HDCP Keys
Video Processor	Anchor Bay	Edge 101	8
Media Server	Apple	Apple TV	16
Media Server	Crestron	ADMS	16
Media Player	DVICO	TViX HD M-6500A	none
Game System	Microsoft	XBOX 360	16
Media Server	Roku	N1000	16
Game System	Sony	PS3	16
Media Server	Vudu	VUDUBX100	16
Media Server	Western Digital	WDTV	No HDCP

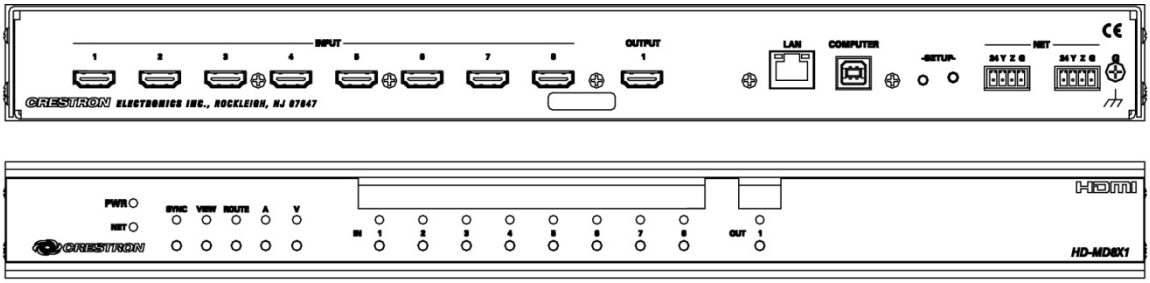
Appendix C - HDMI Solutions

All the following HDMI Solutions are compatible with DigitalMedia products.

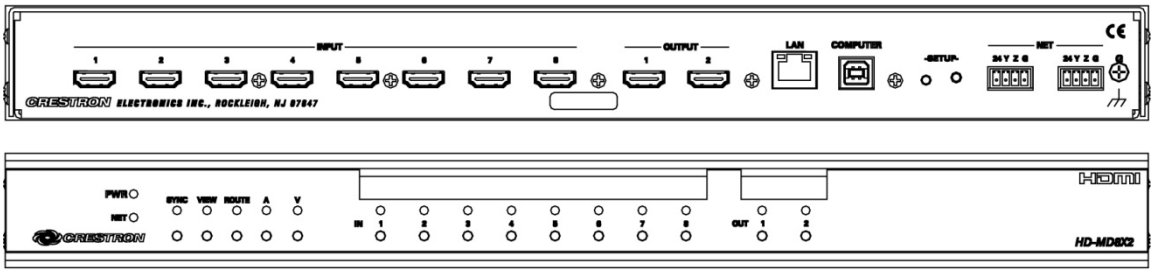
HD-MD8X1 and HD-MD8X2 Switchers

QuickSwitch HD™ switchers from Crestron enable high performance HDMI signal selection with groundbreaking new features designed by Crestron to deliver trouble-free, low-latency switching of all your DVD and Blu-ray Disc™ players, HDTV receivers, media servers, game consoles, multimedia computers, surround processors and high-def displays. The HD-MD8X1 model features eight HDMI inputs, and a single HDMI output to feed a video display or processor. The HD-MD8X2 offers two HDMI outputs.

- High-performance 8x1 and 8X2 HDMI switchers
- Low-latency QuickSwitch HD switching technology
- Supports HDMI with Deep Color and 7.1 channel HD lossless audio
- Compatible with DVI and DisplayPort Multimode (adapters required)
- Supports video resolutions up to WUXGA 1920x1200 and HD 1080p60
- Detects and reports detailed video and audio input information
- Manages HDCP digital rights management for connected devices
- Performs automatic AV signal format management via EDID
- Includes front panel controls with security lockout
- Allows audio breakaway switching
- Enables device control via CEC
- Simple setup and diagnostics via software
- Native control system integration via Ethernet or Cresnet
- Provides input expansion for the AMS-AIP or other HDMI products
- Single-space 19-inch rack-mountable



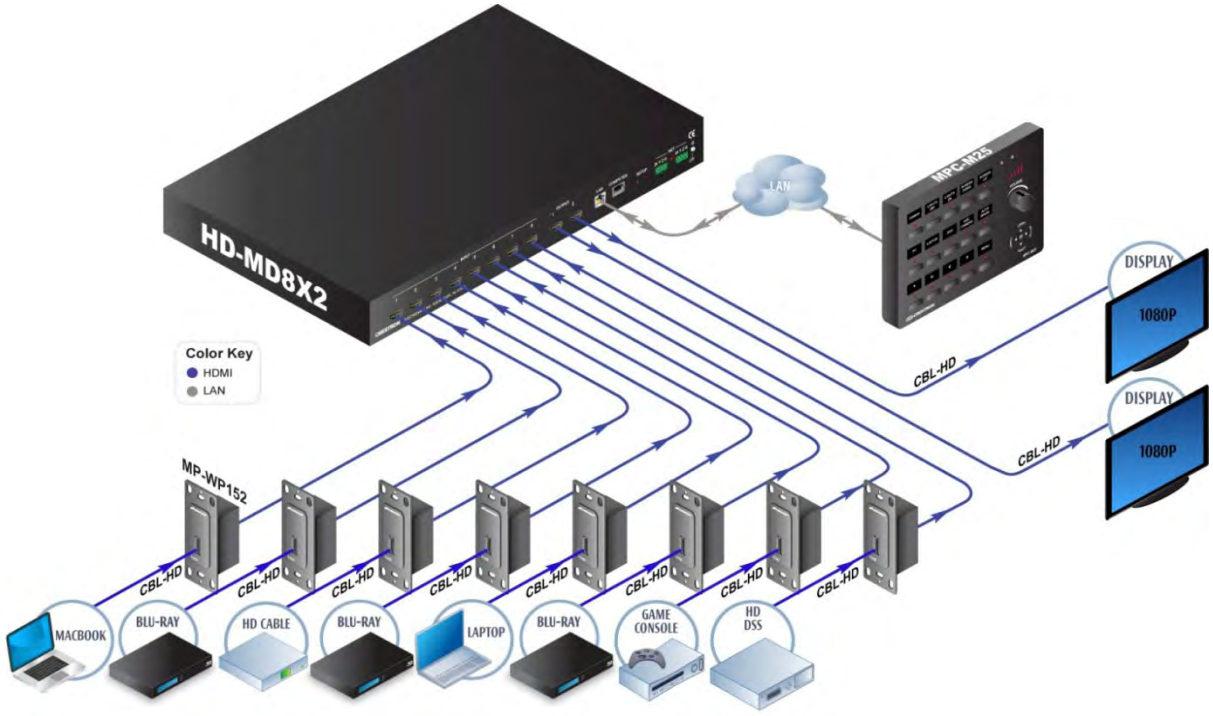
HD-MD8X1



HD-MD8X2

HD-MD8X2 Application

Advanced HDMI switcher featuring low-latency QuickSwitch HD™ switching technology, HDCP management, EDID resolution reporting, CEC device control access, audio breakaway, and native Crestron control via Cresnet or Ethernet.



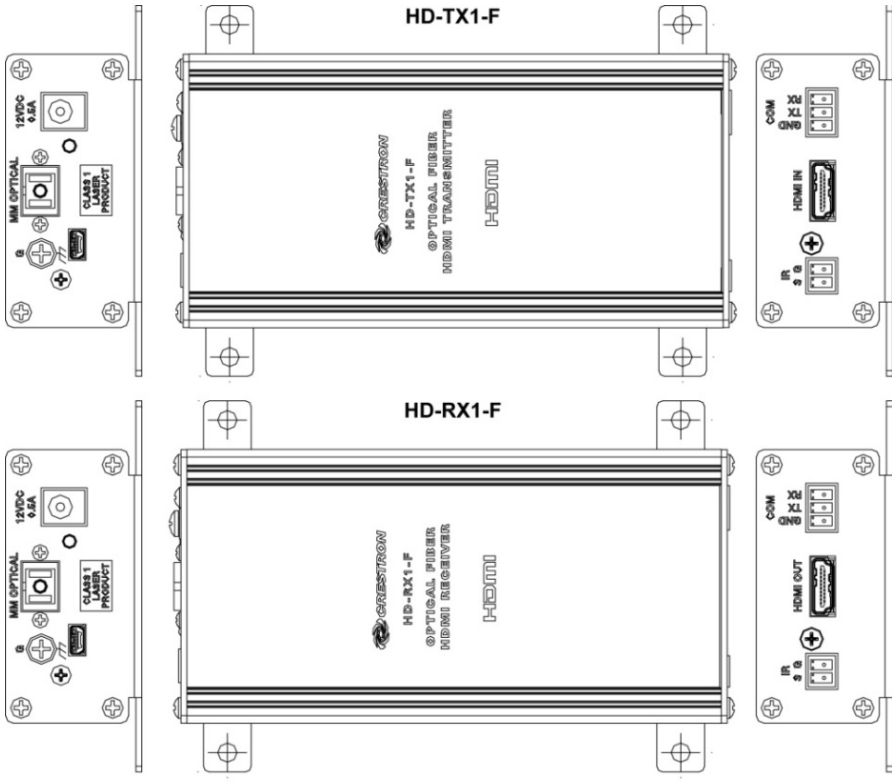
HD-RX1-F Receiver and HD-TX1-F Transmitter

Crestron HDMI over Fiber Transmitters and Receivers deliver straightforward, cost-effective digital AV signal extension for use in the home, classroom, or corporate boardroom. The HD-RX1-F receiver works with the HD-TX1-F transmitter (sold separately) to enable wire runs up to 1000 feet using just a single multimode fiber cable (For MM OPTICAL fiber wiring, use CRESFIBER-SINGLE-SC or other quality simplex multimode fiber optic cable).

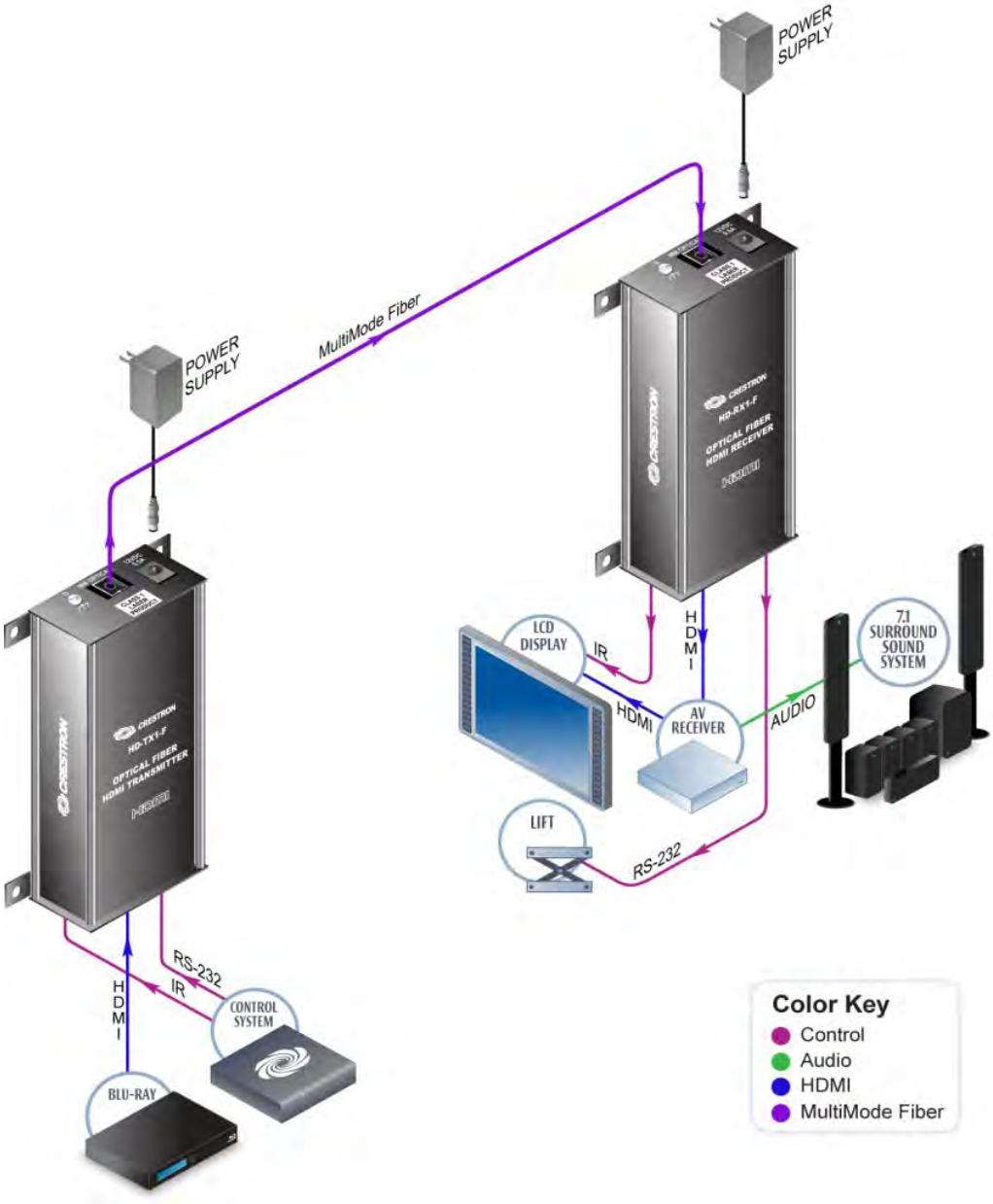
The HD-RX1-F and HD-TX1-F feature a single HDMI output, supporting high-quality HDMI with Deep Color and 7.1 channel HD lossless audio, as well as DVI video signals (HDMI requires an appropriate adapter or interface cable to accommodate a DVI signal. CBL-HD-DVI interface cables available separately), for connection to a High Definition video display, projector, computer monitor, or AV processor. Additional IR and bidirectional RS-232 ports are also provided, allowing control signals to be routed along with the HDMI signal for a true one-wire AV interface solution. For a solution with even more features, see the HD-RX3-F and HD-TX3-F products.

The HD-RX1-F and HD-TX1-F are housed in attractive, compact enclosures, with provisions for mounting to any flat surface, or to one rail of a 19 inch EIA equipment rack. Crestron also offers a complete range of professional AV interface cables and wall plates for a total custom installation solution.

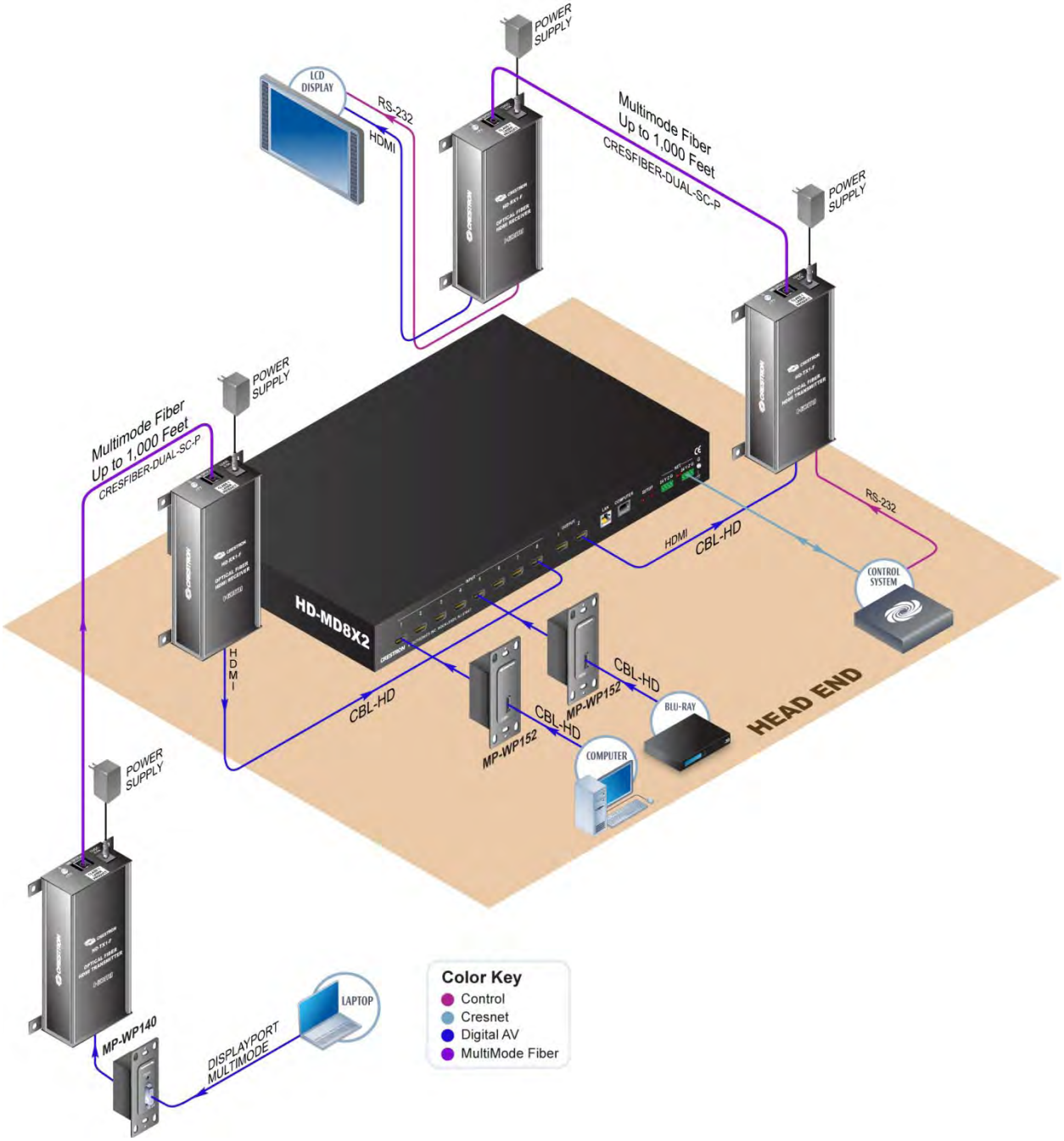
- Extends uncompressed digital video, audio, and control signals 1000 feet over a single multimode fiber
- Supports HDMI with Deep Color
- Supports 7.1 channel HD lossless audio up to 48 kHz
- Also compatible with DVI
- Handles resolutions up to 1920x1200 and 1080p60
- Passes EDID, CEC, and HDCP
- Universal IR repeater up to 192kHz
- Bidirectional RS-232 extender up to 115k Baud
- No programming or configuration needed
- 12 VDC power pack included



HD-TX1-F and HD-RX1-F Application Example 1



HD-TX1-F and HD-RX1-F Application Example 2

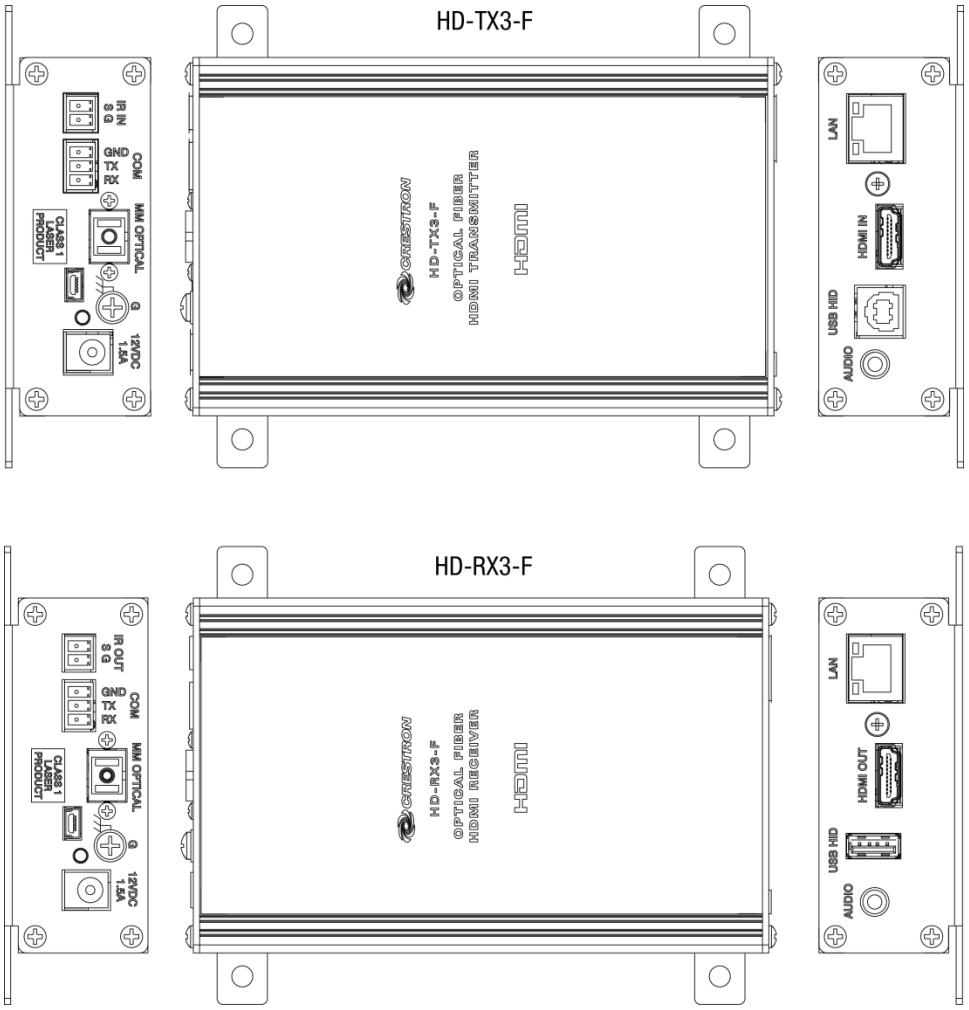


HD-RX3-F Receiver and HD-TX3-F Transmitter

The HD-RX3-F and HD-TX3-F work together to extend uncompressed HDMI, analog audio, Ethernet, USB HID, and control signals up to 1000 feet over a single fiber optic cable. Hide the thin fiber in plain sight without drilling holes or tearing into walls. Use the CresFiber CLEAR cable to conceal the fiber along baseboards and in corners.

The HD-RX3-F receiver and HD-TX3-F transmitter support HDMI 1.3a with deep color and 7.1 channel lossless audio. Ethernet speeds up to 10/100 are supported as well. Each unit has a single HDMI port, a USB HID port, a mini-TRS port, an Ethernet port, a COM port, and an IR port.

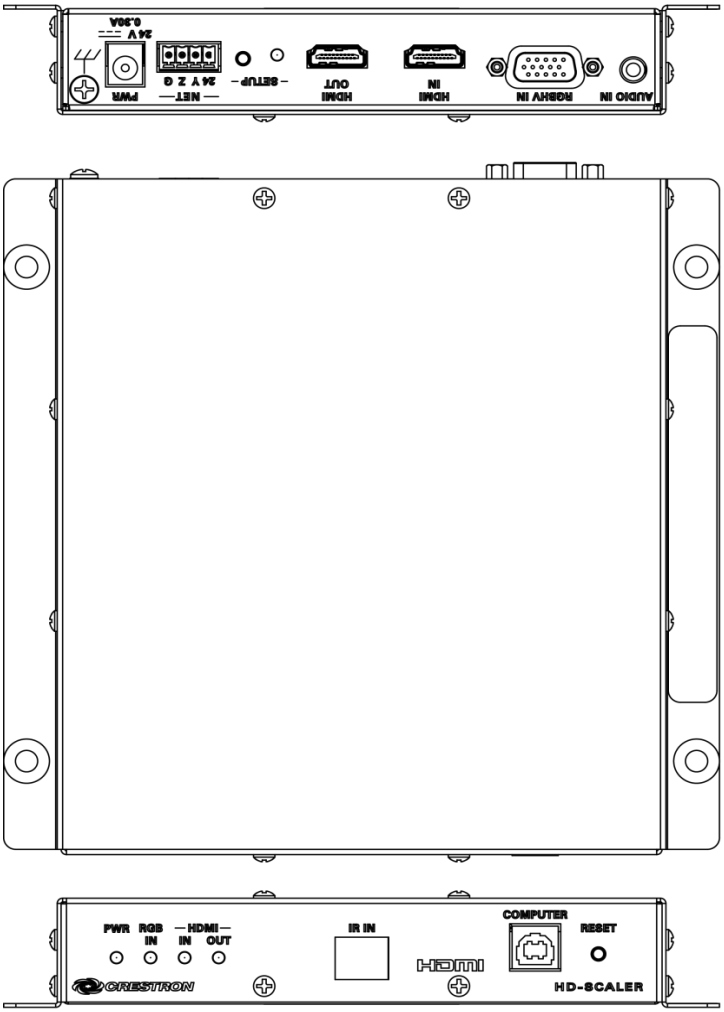
- Extends uncompressed digital video, audio, networking, HID, and control signals 1000 feet over a single multimode fiber
- Works reliably without any programming or configuration
- Supports HDMI 1.3a with Deep Color
- Supports 7.1 channel lossless audio up to 48 kHz
- Also compatible with DVI and DisplayPort Multi-mode
- Includes analog stereo audio input/output
- Handles resolutions up to 1920x1200 and 1080p60
- Passes CEC, EDID and HDCP
- Supports 100Base-T Fast Ethernet
- Includes universal IR repeater up to 192kHz
- Extends bidirectional RS-232 up to 115k Baud
- Includes built-in USB HID mouse/keyboard extender
- Provides electrical isolation for outdoor runs
- 12VDC power pack included



HD-SCALER

The HD-SCALER scales the input signal to match the native resolution of your display or other HDMI device. The HD-SCALER integrates seamlessly with a DigitalMedia system and has a variety of input capabilities.

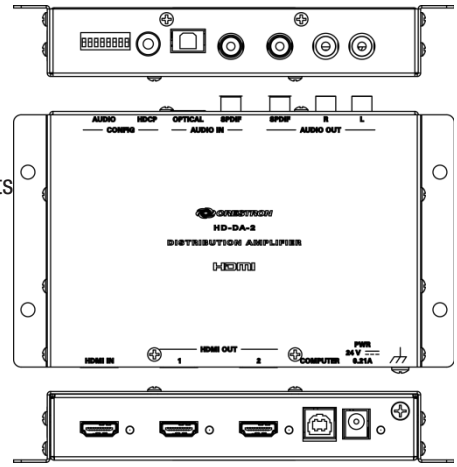
- Compact, low-profile surface mount design - fits behind a flat panel display or above a projector
- Automatically scales any input signal to match the native resolution of your display
- Perfect for adapting all kinds of video devices to handle any resolution
- 100% HDCP compliant with all the intelligence of Crestron DigitalMedia
- Provides one HDMI digital video/audio output
- Includes HDMI, RGB/video, and analog audio inputs
- Supports RGBHV, RGBS, RGsB, component, composite, and S-Video analog sources
- Supports HDMI, DVI, and DisplayPort Multimode digital sources
- Features built-in 2x1 auto-switching
- Equipped with 125 pre-defined input resolutions
- Affords ability to define any custom resolution
- Allows adjustable overscan up to 5%
- Displays EDID, HDCP, and input signal information on screen
- Includes built-in test patterns for precise display setup
- Configurable via OSM using IR remote (included)
- Allows control system interface via Cresnet
- Integrates seamlessly with Crestron MPS and DigitalMedia
- Mini-TRS audio input



HD-DA-2

The HD-DA-2 is a compact wall or rack mountable 1-to-2 HDMI distribution amplifier. With the HD-DA-2, the audio portion of an HDMI signal can be added or extracted easily on the fly. The HD-DA-2 can split an HDMI signal into video for the display and audio for the surround sound processor. The audio is available in both SPDIF (coaxial) and analog forms. The HD-DA-2 will also do the reverse, merging SPDIF (coaxial or optical) audio with an HDMI video signal into two HDMI outputs. In addition, the HD-DA-2 splits one HDMI input into two HDMI outputs.

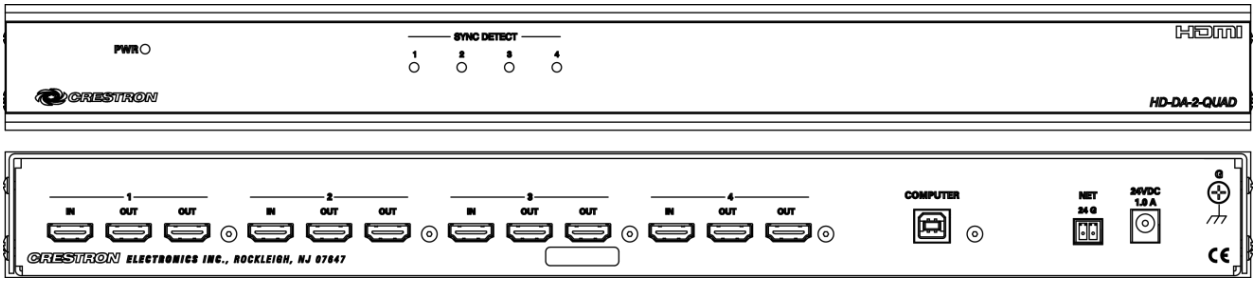
- Three-in-one HDMI toolbox
- Provides a one in, two out HDMI signal splitter
- Enables extracting analog and SPDIF audio signals from the HDMI source
- Enables embedding SPDIF audio (coax or optical) onto the HDMI outputs
- Creates an HDMI signal from separate video (HDMI/DVI/DisplayPort Multimode) and audio (SPDIF) sources
- Supports HDMI w/Deep Color and 7.1 channel HD lossless audio
- Includes front panel input signal and HDCP status indicators
- Allows versatile configuration of audio EDID and HDCP key handling
- No programming or control system required



HD-DA-2-QUAD

The HD-DA-2-QUAD provides four independent 1-to-2 HDMI distribution amplifiers in a single rack-space unit. EDID and HDCP management is built-in. Common uses are to split four HDMI sources or expand the outputs of an HD-MD8X2.

- Provides four independent HDMI splitters
- Enables audio “loop-thru” for DVPHD inputs
- Supports HDMI 1.3a with Deep Color and 7.1 channel HD lossless audio
- Passes EDID, CEC, and HDCP
- Compatible with DVI and DisplayPort Multimode*
- Supports video resolutions up to WUXGA 1920x1200 and HD 1080p60
- Includes front panel input sync LEDs
- Manages HDCP digital rights management for connected devices
- Performs automatic AV signal format management via EDID
- Single-space 19-inch rack-mountable
- Includes external power supply
- No programming or control system required



Appendix D: Crestron Certified Cables

Bulk Cables

Original DigitalMedia Cable

	DM-CBL-NP-SP500	500 ft spool	(1) High-bandwidth/low-crosstalk shielded 4-twisted pair (1) CAT5e and (1) DMNet control cable	non-plenum	blue w/red stripe
	DM-CBL-P-SP500	500 ft spool	(1) High bandwidth/low-crosstalk shielded 4-twisted pair (1) CAT5e and (1) DMNet control cable	plenum	blue w/yellow stripe
	DM-CBL-D-NP-SP500	500 ft spool	High-bandwidth/low-crosstalk shielded 4-twisted pair	non-plenum	blue
	DM-CBL-D-P-SP500	500 ft spool	High-bandwidth/low-crosstalk shielded 4-twisted pair	plenum	blue

NOTE: Every patch point insertion or MP-WP185 wall plate reduces overall DM cable run length by 10 feet.

DigitalMedia 8G Cable

	DM-CBL-8G-NP-SP500	500 ft spool	(1) DM 8G shielded 4-twisted pair	non-plenum	blue
	DM-CBL-8G-P-SP500	500 ft spool	(1) DM 8G shielded 4-twisted pair	plenum	blue

CresFiber® 8G

	CRESFIBER8G-NP-SP500	500 ft spool	CresFiber Multimode Fiber Optic Cable - 50/125 x4 breakout	non-plenum	orange w/ black text
	CRESFIBER8G-NP-SP1000	1000 ft spool	CresFiber Multimode Fiber Optic Cable - 50/125 x4 breakout	non-plenum	orange w/ black text
	CRESFIBER8G-P-SP500	500 ft spool	CresFiber Multimode Fiber Optic Cable - 50/125 x4 breakout	plenum	orange w/ black text
	CRESFIBER8G-P-SP1000	1000 ft spool	CresFiber Multimode Fiber Optic Cable - 50/125 x4 breakout	plenum	orange w/ black text

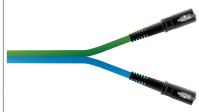
Pre-Terminated CresFiber

CresFiber Clear cables are pre-terminated, transparent, and under 1mm in diameter. Install along molding or corners for an invisible solution without drilling holes in walls. CresFiber patch cables are pre-terminated and plenum-rated.

CresFiber Single

CRESFIBER-SINGLE-SC-P-1.5	1.5 ft	Simplex Multimode Fiber Optic Cable	plenum	no armor
CRESFIBER-SINGLE-SC-P-3	3 ft	Simplex Multimode Fiber Optic Cable	plenum	no armor
CRESFIBER-SINGLE-SC-P-6	6 ft	Simplex Multimode Fiber Optic Cable	plenum	no armor
CRESFIBER-SINGLE-SC-P-12	12 ft	Simplex Multimode Fiber Optic Cable	plenum	no armor
CRESFIBER-SINGLE-SC-P-20	20 ft	Simplex Multimode Fiber Optic Cable	plenum	no armor
CRESFIBER-SINGLE-SC-P-30	30 ft	Simplex Multimode Fiber Optic Cable	plenum	no armor
CRESFIBER-SINGLE-SC-ARMORED-P-60	60 ft	Simplex Multimode Fiber Optic Cable	plenum	armor
CRESFIBER-SINGLE-SC-ARMORED-P-100	100 ft	Simplex Multimode Fiber Optic Cable	plenum	armor
CRESFIBER-SINGLE-SC-ARMORED-P-200	200 ft	Simplex Multimode Fiber Optic Cable	plenum	armor
CRESFIBER-SINGLE-SC-ARMORED-P-300	300 ft	Simplex Multimode Fiber Optic Cable	plenum	armor

CresFiber Dual



CRESFIBER-DUAL-SC-P-1.5	1.5 ft	Duplex Multimode Fiber Optic Cable	plenum	no armor
CRESFIBER-DUAL-SC-P-3	3 ft	Duplex Multimode Fiber Optic Cable	plenum	no armor
CRESFIBER-DUAL-SC-P-6	6 ft	Duplex Multimode Fiber Optic Cable	plenum	no armor
CRESFIBER-DUAL-SC-P-12	12 ft	Duplex Multimode Fiber Optic Cable	plenum	no armor
CRESFIBER-DUAL-SC-P-20	20 ft	Duplex Multimode Fiber Optic Cable	plenum	no armor
CRESFIBER-DUAL-SC-P-30	30 ft	Duplex Multimode Fiber Optic Cable	plenum	no armor
CRESFIBER-DUAL-SC-ARMORED-P-60	60 ft	Duplex Multimode Fiber Optic Cable	plenum	armor
CRESFIBER-DUAL-SC-ARMORED-P-100	100 ft	Duplex Multimode Fiber Optic Cable	plenum	armor
CRESFIBER-DUAL-SC-ARMORED-P-200	200 ft	Duplex Multimode Fiber Optic Cable	plenum	armor
CRESFIBER-DUAL-SC-ARMORED-P-300	300 ft	Duplex Multimode Fiber Optic Cable	plenum	armor

CresFiber Clear

	CRESFIBER-SINGLE-SC-CLEAR-NP-30	30 ft	Simplex Multimode Fiber Optic Cable	transparent	
	CRESFIBER-SINGLE-SC-CLEAR-NP-60	60 ft	Simplex Multimode Fiber Optic Cable	transparent	
	CRESFIBER-SINGLE-SC-CLEAR-NP-100	100 ft	Simplex Multimode Fiber Optic Cable	transparent	

V-Cable Triamese Cables

V-CBL-T

Crestron V-Cable Triamese Cables provide clean, flexible connectivity for our DM CAT-based V-Panel touchpanel displays (V12 and V15). Available in black or white and in 3, 6, 9, and 15 feet lengths, V-Cables provide an unobtrusive solution for connecting the touchpanel to a wall plate or running across a desk top. Their durable yet flexible construction allows V-Cables to fit neatly inside the base of a tilt model V-Panel, or dress cleanly behind a VESA-mounted V-Panel.

The V12 and V15 model V-Panels are each furnished with one 3 ft V-Cable included, while V12-TILT and V15-TILT models include one 15 ft V-Cable each. Other lengths may be purchased for use with any V-Panel that features DM CAT type connections.

V-Cables may also be used with a Crestron DigitalMedia™ system wherever a short, flexible interface cable is required, such as between a DM CAT transmitter and MP-WP185 wall plate.

NOTE: No more than two V-Cables should be used in a given DM signal path.

Interface Cables

Crestron Interface Cables support all types of analog and digital video and audio signals. A durable yet flexible CL3-rated jacket affords excellent handling with allowance for in-wall installation.

	CBL-HD HDMI interface cable – Non-Plenum Jacket **Available Lengths:** 1.5, 3, 6, 12, 20, and 30 ft		**CBL-DVI** DVI-I interface cable – Non-Plenum Jacket **Available Lengths:** 1.5, 3, 6, 12, 20, and 30 ft
	CBL-DP-HD DisplayPort to HDMI interface cable – Non-Plenum Jacket **Available Lengths:** 1.5, 3, 6, 12, 20, and 30 ft		**CBL-HD-DVI** HDMI to DVI interface cable – Non-Plenum Jacket **Available Lengths:** 1.5, 3, 6, 12, 20, and 30 ft
	CBL-AUDIO 1/8” Mini-TRS unbalanced stereo audio interface cable – Non-Plenum Jacket **Available Lengths:** 1.5, 3, 6, and 12 ft		**CBL-RCA** RCA composite video or S/PDIF digital audio interface cable – Non-Plenum Jacket **Available Lengths:** 1.5, 3, 6, 12 ft
	CBL-RCA2 RCA stereo audio interface cable – Non-Plenum Jacket **Available Lengths:** 1.5, 3, 6, 12 ft		**CBL-RCA3** RCA component video interface cable – Non-Plenum Jacket **Available Lengths:** 1.5, 3, 6, 12 ft
	CBL-VGA-AUD DB15HD computer VGA interface cable w/ Mini-TRS audio – Non-Plenum Jacket **Available Lengths:** 3, 6, 12, 25 ft		**CBL-VGA** DB15HD computer VGA interface cable – Non-Plenum Jacket **Available Lengths:** 1.5, 3, 6, 12, 25 ft

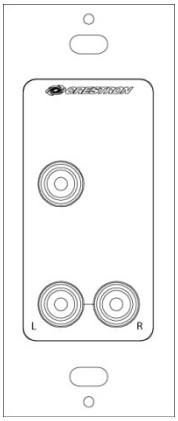
Appendix E: Media Presentation Wall Plates

Media Presentation Wall Plates (available in black and white) complete the total Crestron package, ensuring end-to-end Crestron quality for every installation. A range of wall plates is offered to support all types of analog and digital video, audio, and control signals. These single-gang wall plates fit off-the-shelf decorative wall plates and are gang-able for custom wall, lectern and rack mount applications.

MP-WP100

RCA Composite Video with RCA Stereo Audio

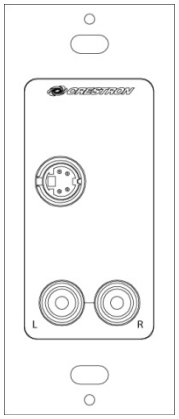
Three gold-plated RCA connectors color-coded and labeled for composite video and stereo audio. Bulkhead type feed-thru connectors are used, providing female RCA connections at the rear.



MP-WP110

Mini-DIN S-Video with RCA Stereo Audio

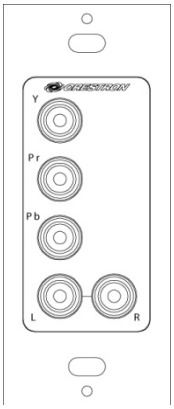
One gold-plated 4-pin mini-DIN connector and two gold-plated RCA connectors color-coded and labeled for S-video and stereo audio. Bulkhead type feed-thru connectors are used, providing female mini-DIN and RCA connections at the rear.



MP-WP120

RCA Component Video with RCA Stereo Audio

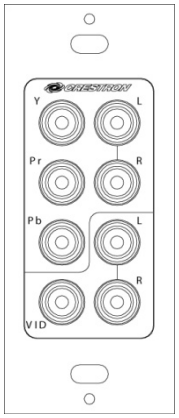
Five gold-plated RCA connectors color-coded and labeled for component video and stereo audio. Bulkhead type feed-thru connectors are used, providing female RCA connections at the rear.



MP-WP125

RCA Component & Composite Video with two RCA Stereo Audio jacks

Eight gold-plated RCA connectors color-coded and labeled for separate component and composite video and stereo audio. Bulkhead type feed-thru connectors are used, providing female RCA connections at the rear.



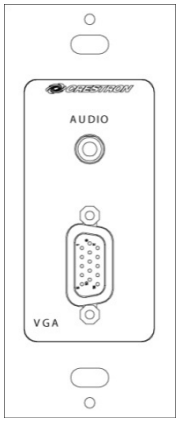
MP-WP130 & MP-WP131

DB15HD Computer VGA w/Mini-TRS Stereo Audio Bulkhead

One female DB15HD connector (i.e., HD-15, DE-15) and one 1/8” mini-TRS connector, labeled for computer VGA and stereo audio.

MP-WP130: A bulkhead type feed-thru connector is used, providing a female DB15HD connection at the rear. Audio wiring is connected via a 3-pin terminal block.

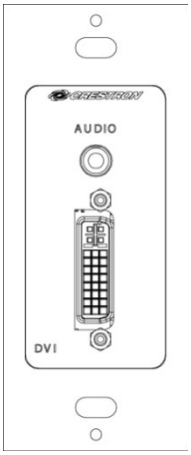
MP-WP131: A 12” breakout cable assembly at the rear provides five BNC connections. Audio wiring is connected via a 3-pin terminal block.



MP-WP140

Media Presentation Wall Plate - DVI-I w/Mini-TRS Stereo Audio

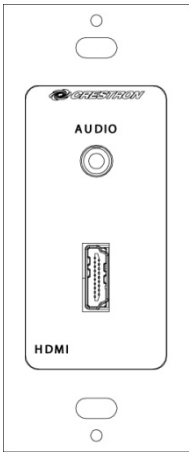
One Dual Link DVI-I connector and one 1/8” mini-TRS connector, labeled for DVI and stereo audio. A bulkhead type feed-thru connector is used, providing a female DVI-I connection at the rear. Audio wiring is connected via a 3-pin terminal block.



MP-WP150

Media Presentation Wall Plate - HDMI™ w/Mini-TRS Stereo Audio

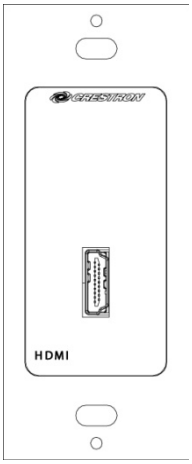
One Type A HDMI connector and one 1/8” mini-TRS connector, labeled for HDMI and stereo audio. A bulkhead type feed-thru connector is used, providing a female HDMI connection at the rear. Audio wiring is connected via a 3-pin terminal block.



MP-WP152

Media Presentation Wall Plate - HDMI™

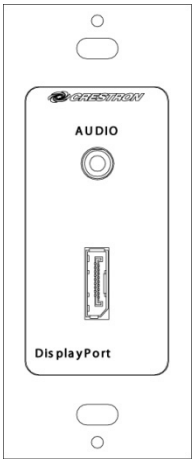
One Type A HDMI connector. A bulkhead type feed-thru connector is used, providing a female HDMI connection at the rear.



MP-WP160

Media Presentation Wall Plate - DisplayPort w/Mini-TRS Stereo Audio

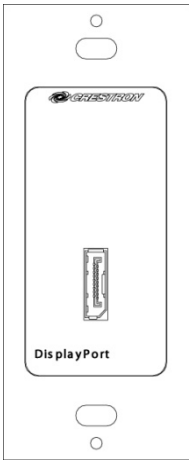
One DisplayPort connector and one 1/8” mini-TRS connector, labeled for DisplayPort and stereo audio. A bulkhead type feed-thru connector is used, providing a female DisplayPort connection at the rear. Audio wiring is connected via a 3-pin terminal block.



MP-WP162

Media Presentation Wall Plate - DisplayPort

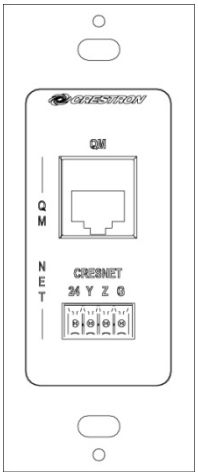
One DisplayPort connector. A bulkhead type feed-thru connector is used, providing a female DisplayPort connection at the rear.



MP-WP180

Media Presentation Wall Plate - Crestron QuickMedia™ w/ Cresnet

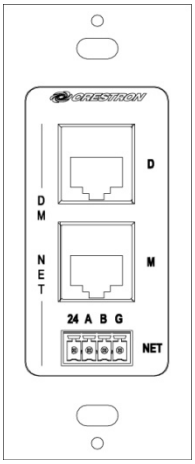
One female 8-pin RJ-45 connector, and one 4-pin 3.5mm detachable terminal block, labeled for QuickMedia™ and Cresnet®, respectively. Bulkhead type connectors are used, providing a female RJ-45 and detachable terminal block connections at the rear.



MP-WP185

Media Presentation Wall Plate - Crestron DigitalMedia CAT w/ DMNet

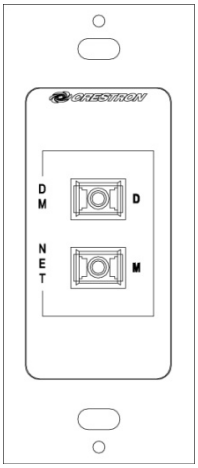
Two female 8-pin RJ-45 connectors, and one 4-pin 3.5mm detachable terminal block, labeled for DigitalMedia. Bulkhead type connectors are used, providing female RJ-45 and detachable terminal block connections at the rear.



MP-WP186

Media Presentation Wall Plate - Crestron DigitalMedia Fiber

Two female SC type optical fiber connectors, labeled for DigitalMedia. Bulkhead type feed-thru connectors are used, providing female SC connections at the rear.

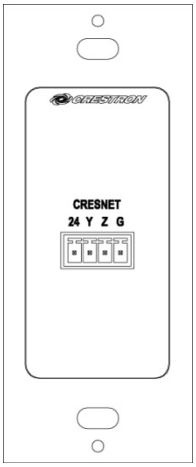


MP-WP190

Media Presentation Wall Plate - Cresnet

One 4-pin 3.5mm detachable terminal block, labeled for Cresnet control.

A paralleled terminal block connection is provided at the rear.



Glossary

Video Resolution Terminology

1080i

An HDTV standard that specifies an interlaced resolution of 1920 x 1080.

1080p

1080p refers to the 1920x1080 “progressive scan” HDTV format. 1080p is currently the highest resolution in the HDTV standard.

480i

480 interlaced; a form of standard definition digital television (SDTV) that approximates the quality of analog television but not considered high definition television (HDTV). Even though the native resolution of DVDs is 480p, they are viewed at 480i on an NTSC analog television.

480p

480 progressive; a form of standard definition digital television (SDTV) comparable to VGA computer displays but not considered high definition television (HDTV), though 480p is discernibly cleaner and slightly sharper than analog television. The native resolution of DVD is 480p, but that resolution can be seen only if a DVD player outputs a progressive scan signal and the DTV has progressive scan or component video inputs; it is also known as EDTV.

720p

720 progressive; one of two currently used formats designated as high definition television in the ATSC DTV standard, this technology comprises 720 vertical pixels and 1,280 horizontal pixels. The *p* stands for progressive, as opposed to interlaced, scanning, which is used in the other accepted HDTV standard, known as 1080i. Contrary to myth, 720p is not inferior to 1080i; 720p has fewer lines but also has the advantages of progressive scanning and a constant vertical resolution of 720 lines, making it better able to handle motion.

Deep Color

A color depth standard associated with high definition TVs and video gear that include HDMI 1.3 connections. The Deep Color standard supports 10-bit, 12-bit and 16-bit color depths, up from 8-bit, which is the current standard for consumer video. DigitalMedia supports all but the 16-bit color depth. All earlier versions of HDMI just supported 8-bit color. (Because video is based on three primary colors, you’ll sometimes see Deep Color described as 30-bit, 36-bit and 48-bit.) A higher color bit depth enables finer gradations between different shades of the same color, for smoother gradients and reduced color banding. Deep Color gives TVs the potential to display billions rather than millions of colors, but in order to see that improvement, the entire video production chain has to use it (camera, editing, format, player, display).

Down-convert

In DTV, the conversion from a higher resolution input signal number to a lower one. For example, some DTV receivers can be set to down-convert an HDTV 1080i signal to a standard 480i signal that any TV can display.

Video Display Terminology

Aspect Ratio

The ratio of width to height in a video picture or other graphic image. Traditional U.S. TV broadcasts and computer monitors feature a 4:3 aspect ratio; HDTV has a 16:9 ratio.

16:9

Sometimes expressed as 16 x 9 or 16 by 9 (known as 1.78:1 in the film world). The standard DTV widescreen television screen size, or aspect ratio, which is 16 arbitrary units wide by nine arbitrary units high, as compared to a standard TV aspect ratio of 4:3. The phrase describes the shape of a TV set or program, not an actual inch measurement.

4:3

Standard “square” NTSC TV screen size aspect ratio of four arbitrary units wide by three wide arbitrary units high; often expressed as 4x3 or 4 by 3. It was originally known as the Academy Ratio (as in Academy of Motion Picture Arts and Sciences, the film industry organization that awards the Oscars) prior to 1954 and the introduction of widescreen aspect ratio film formats; also known in the film world as 1.33:1.

Anamorphic

Adopted from the film technique of shooting a widescreen image on a square 35mm frame, it›s the process of compressing widescreen images to fit into the squarer standard 4:3 television signal. The images are then expanded for viewing in their original format on a widescreen display device. Widescreen or letterboxed DVDs that are not anamorphic have less detail when projected on a widescreen monitor. In other words, a non-anamorphic widescreen DVD is designed to be shown letter-boxed on a standard “square” TV but appears with a black box all around the image when shown on a larger 16:9 widescreen TV. To fill a 16:9 screen, a non-anamorphic DVD has to be stretched, resulting in loss of resolution and detail. Conversely, a DVD that is anamorphic, enhanced for 16:9, or enhanced for widescreen, delivers 33 percent more resolution than regular letterboxed transfers. It was designed to be shown on a 16:9 TV, and does not need to be manipulated to fit. When one of these DVDs is shown on a “square” TV, it is often subject to anamorphic down-conversion artifacts unless the TV has a vertical compression feature.

Anamorphic down-conversion

Processing present in all DVD players that converts the image from an anamorphic DVD for display on a regular 4:3 TV. In the initial setup of a DVD player is a choice between a 16:9 or a 4:3 TV; the 4:3 options engage this processing, which often introduces artifacts such as jaggies and undulations during pans.

Component video

The elements that make up a video signal, consisting of luminance and two separate chrominance signals, expressed either as Y R-Y B-Y or Y P_b P_r.

DisplayPort

A digital display interface standard put forth by the Video Electronics Standards Association (VESA) that defines a new license-free, royalty-free, digital audio/video interconnect, intended to be used primarily between a computer and its display monitor or a computer and a home theater system.

DisplayPort Multimode

This version of DisplayPort can be converted to HDMI, DVI or RGBHV. Virtually 100% of DisplayPort sources today implement this version.

DVI

Digital Visual Interface; a digital interface specification created by an industry consortium, the Digital Display Working Group. This universal standard for connecting flat panel monitors is also used for data projectors, plasma displays, and digital TVs. Using a DVI connector and port, a digital signal sent to an analog device is converted into an analog signal (if the device is digital, such as a flat panel monitor, no conversion is necessary). There are three different DVI configurations: DVI-A for analog signals, DVI-D for digital signals, and DVI-I (integrated) for both analog and digital signals.

DTV

Digital television is a generic term that refers to all digital television formats, including high definition television (HDTV) and standard definition television (SDTV).

HDMI

High Definition Multimedia Interface. USB-like digital video connectivity standard designed as a successor to DVI. Transmits both digital audio and video signals and incorporates HDCP digital copy protection.

Interlaced scanning

Scanning method used by the 1080i HDTV format. As opposed to progressive scanning, in which the CRT›s electron beam scans or “paints” all lines at once, interlaced scanning TVs paint odd-numbered lines in succession, then go back and fill in the remaining even-numbered lines. This method is more prone to artifacts and less stable than progressive.

Progressive scan

A method of displaying images on a CRT monitor or a high definition TV in which all the lines of a picture are drawn in one quick burst, from left to right and from top to bottom. Compare this to interlacing, in which every other line is displayed in two successive swoops to form a complete picture.

SDTV

Standard definition television. Digital television format that includes 480-line resolution in both interlaced (480i) and progressively scanned (480p) formats; offers discernible improvement over conventional analog NTSC picture resolution, with less noise; similar to DVD or satellite TV quality but not considered high definition.

Widescreen

An image with an aspect ratio greater than 1.33:1, or a picture wider and narrower than a traditional television image. Typically refers to TVs in the 16:9 aspect ratio.

Y Pb Pr

Luminance, and two chrominance channels of blue minus luminance and red minus luminance. This technical shorthand for component video is also written as Y Cb Cr (or Y R-Y B-Y).

Encoding Terminology

AC-3

This digital surround sound format for home audio is called Dolby Digital in theaters. It is a 5:1 format, with six separate audio tracks. AC-3 has been chosen as the official sound format for digital TV and is commonly used to encode DVD soundtracks.

Authentication

Authentication ensures that digital data transmissions are delivered to the intended receiver. Authentication also assures the receiver of the integrity of the data and its source. The simplest form of authentication requires a username and a password to gain access to a particular account. But authentication protocols can also be based on secret key encryption, such as DES, or on public key systems using digital signatures.

DRM

Digital Rights Management is a secure technology that enables the copyright owner of a piece of intellectual property (such as a music, video, or text file) to specify what a user can do with it. Typically, this is used to offer downloads that can›t be played or burned to CD without paying for a license.

HDCP

High-bandwidth Digital Content Protection. A copy protection scheme developed by Intel used in conjunction with DVI and HDMI connections.

KSV

A set of numbers transmitted between HDCP-protected sources and sinks during the authentication ‘handshake’ to validate that the devices are authorized to receive the content. Some HDMI sources have limited buffer space to hold KSVs and as such can only be routed to a few HDMI devices before their buffer overflows and content playback stops.

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